TECHNOLOGY DEPT.

January 4, 1943

STEEL

PRODUCTION • PROCESSING • DISTRIBUTION • USE

IN TWO SECTIONS ESTABLISHED 1882 SECTION ONE

"Proceeding With Assigned Task"

OUR assigned task is now to give the armed forces what they need to win this war.

To that job we are devoting all our skill and experience in manufacturing DIESEL ENGINES, ELECTRIC MOTORS, PUMPS, and SCALES.

FAIRBANKS, MORSE & CO.

IN 1943 More Precision Faster

with HEALD PRECISION BORING AND GRINDING MACHINES

Building the huge quantities of planes, tanks, guns and ships needed today calls for speed and precision in manufacturing — speed to get vital material quickly to fighting fronts, and precision to insure dependable fighting service.

Both results can be obtained by use of precision boring and precision grinding — hence the universal application of Heald Bore-Matics and Heald Internal and Surface Grinding Machines for all types of finishing operations on vital components of planes, of tanks, of guns, of ships. In fact, in aircraft alone, more than 100 different important parts are precision finished on Heald Machines.

In 1943 Heald Bore-Matics and Internal and Surface Grinding Machines will be in action on every precision front — producing *more precision faster* for industry, for America. Building these vitally needed machines is our job for 1943 — our contribution to Victory.

In 1943 Heald's entire output of precision boring and precision grinding machines will go to the production lines of the nation for precision finishing — an infinite variety of parts used in the matériel of War. Heald Precisionized Parts are found in

aircraft engines . . aircraft propellers . . aircraft landing gear . . aircraft instruments . . aircraft fuselages . . aircraft gun turrets . . ships . . submarines . . tank engines . . tank guns . . motorized military vehicles . . motorcycles . . diesel engines . . gyro instruments . . gun directors . . guns . . machine guns . . anti-aircraft guns . . gun mounts . . rifles . . cartridges . . shells . . torpedoes . . radio . . telephone systems . . searchlight mounts.

HEALD
More Precision Faster

MANUFACTURERS OF PRECISION BORING AND PRECISION GRINDING MACHINES
THE HEALD MACHINE CO., Worcester, Mass., U. S. A.

FOR OUR ARMED FORCES

INDUSTRIAL AMERICA HAS PLEDGED

ALL-OUT AND EVER-INCREASING PRODUCTION

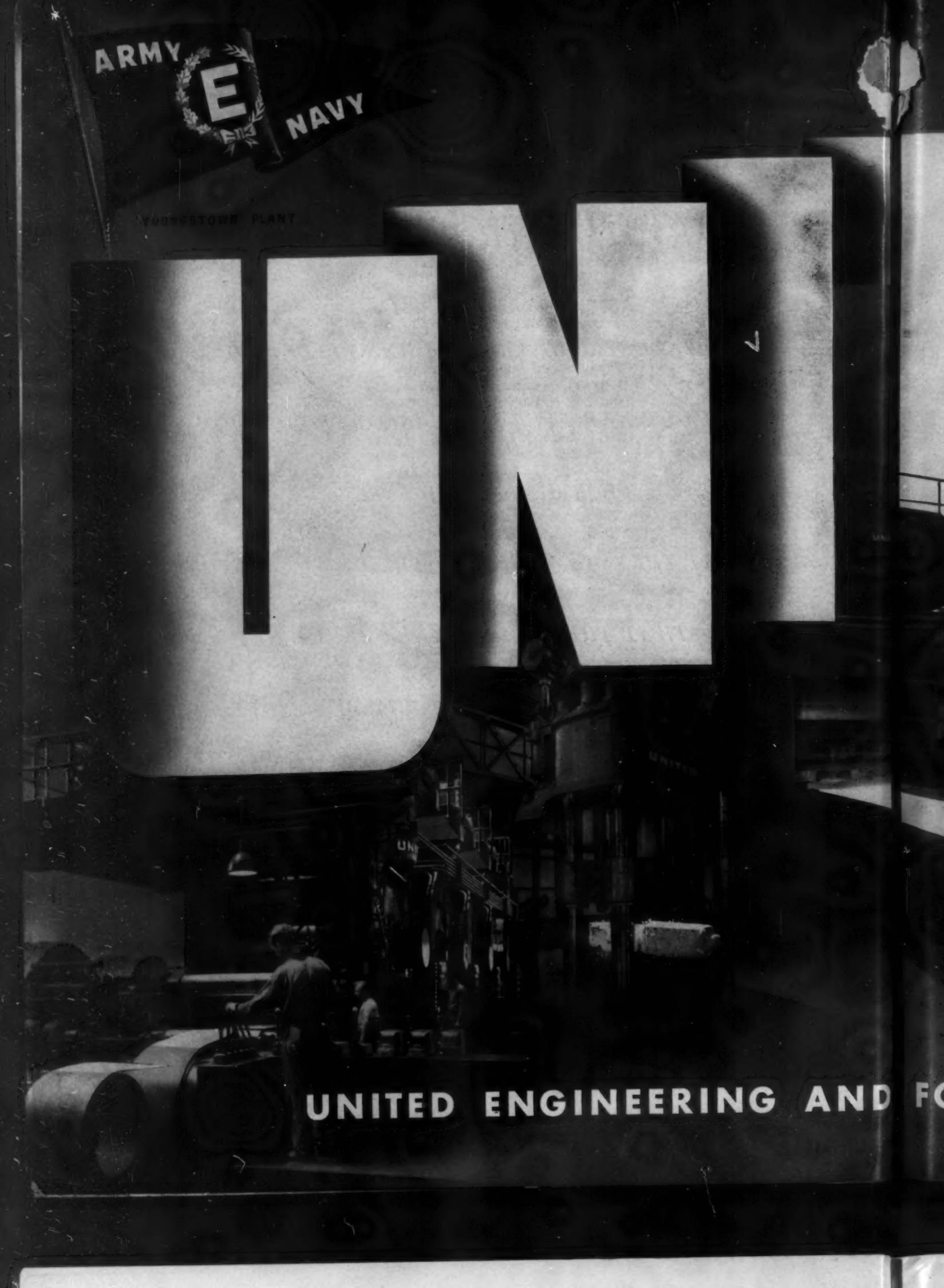
FOR OUR ARMED FORCES

—THAT THEY MAY QUICKEN THE DAY OF VICTORY

—THAT THEY MAY RETURN IN SAFETY

—AND THAT THE WORLD MAY BE ASSURED

OF A LASTING PEACE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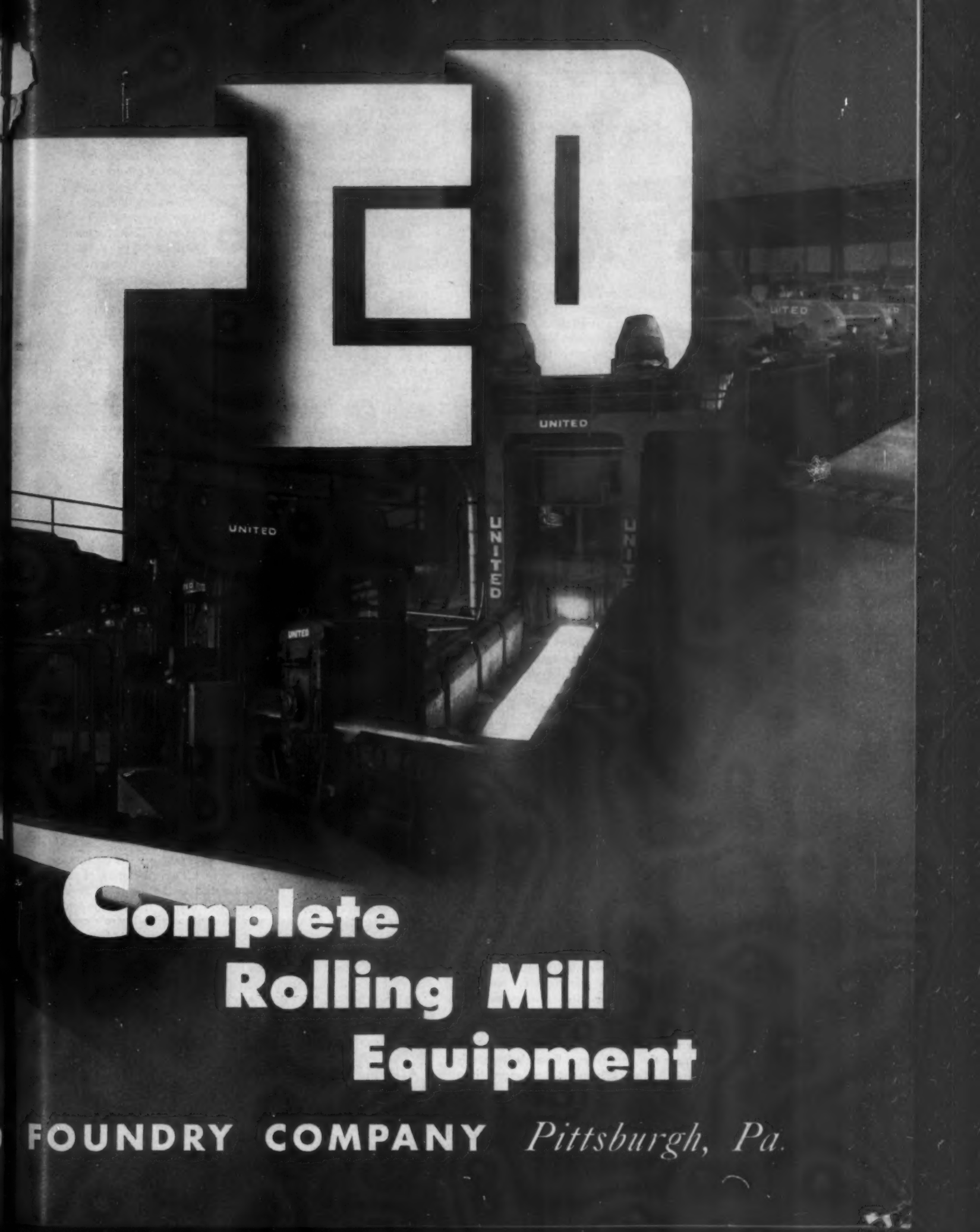


Complete Rolling Mill Equipment

FOUNDRY COMPANY *Pittsburgh, Pa.*

BEHIND THE SCENES

■ Experience so far in World War II shows that on the average each man in the fighting forces requires 4900 pounds of steel or other metals. This is 50 times as much as was necessary in the other war.

With every set back we have taken on the far-flung fronts of this global war, and with every counterpunch our boys have handed back, it has become more and more evident that this is a war of metals. Metals to sail, metals to fly, metals to shoot and bomb, and—yes—metals to cut and stab.

■ During 1942 the metalproducing industry of the United States has turned out what only a few short months ago would have seemed like an inconceivable tonnage. Back in OPM days when few of us envisioned the real scope of the job ahead it was beyond our "experienced" imagination that our full metalproducing capacity could possibly be found wanting. Today we see more clearly the awful hunger of Mars. Today Army-Navy "E" pennants ride over the plants and mills of the country's producers as an official symbol of a mountainous job well done. But to the men and women who are the metalproducing industry, bending every effort to make and break new records, these flags are just symbols of a job well begun. 1943 will see metal production climb on to new heights.

■ But raw steel, aluminum, magnesium, copper and brass are, by themselves, far from an intricate fuze in a shell hurtling over the African desert; far from the whirling propeller of a sleek P-38 diving on a Jap Zero; far from a racing destroyer dashing in for the kill at Guadalcanal. Yes—between bulk tonnage and the fighting weapons which will win this war is the metalworking industry—the magicians of mass production, the transformers of modern miracles, the core of our industrial civilization.

The metalworking industry has been described as making everything from hairpins to battleships, frying pans to freight cars and bedsprings to boring mills. It turns metal into finished, usable products. Out of its shops have come the conveniences we have learned to like so well; out of its laboratories may well come the Utopian future of the dreamer.

■ From mechanical pencils to ammunition components, from paper bag machines to periscope housings; from molding clips to shell fins and from freight elevators to torpedoes the metalworking industry has converted to all-out production for war. Some companies are still making their peacetime products but these are the machines, equipment and parts which, in turn, are needed to make the tools of war.

Just twelve months ago automobile production was slithering to a halt; home radios, refrigerators, washing machines and a thousand and one kitchen conveniences were facing stop and limitation orders. All through the first months of 1942 STEEL was preaching conversion, explaining the new government orders, pointing out restrictions, trying to eliminate the confusion. STEEL's Research Department rechecked factual information on more than 17,000 plants in the metalworking industry, found an increase of 21 per cent over 1940 in the number of manufacturing plants employing over 1000, a definite trend to more large plants, fewer small ones. By midsummer 8645 plants employed more than 50 and despite election politics, despite shortages, despite a maze of priority and allocation confusion, despite hell and high water, the snowball of ordnance production was rolling. From an index of 100 in November, 1941 it had leaped to 357 by August of '42, climbed steadily to 382 in October. The President's quota of 8,000,000 tons of shipping was being bettered; 49,000 planes had taken wing; tanks, guns, shells, trucks, helmets, bombs and rifles were rolling off the metalworking lines of America in the greatest quantities of all time.

Yet this was still just the beginning. 1943's goals are twice what we've done so far. The workers of America have just begun to fight; and they're fighting only to win.

■ Back in September of 1939—at the outbreak of the war in Europe—the editors of STEEL forsaw the possibility of this country again getting into full-scale production of ordnance material and they began at once to round up the available sources of authoritative information. The result of this early planning was an outstanding continuing series of articles on the modern production of ordnance of all types. Because of the demand, this material was reprinted into three ordnance production handbooks and over twelve thousand copies are in use throughout the metalworking industry and the district ordnance offices.

Then as the priority system evolved, STEEL added a special priority service, digesting government orders, explaining new regulations, allocations price schedules and priority forms. Over half a million Priority forms were supplied at cost by STEEL to hundreds of manufacturers who needed them in a hurry and Priority Guides, published as separate booklets, have been a part of STEEL's regular service.

Early in the year STEEL published the first listing of NE (National Emergency) Steels, along with single-heat test results, and since then has given the most complete information available on developments with these low-alloy steels.

As critical materials threatened to slow the production lines, STEEL developed an outstanding original series of articles on conservation and substitution which was commended highly by the Ordnance department and manufacturers throughout the industry.

These are just a few of the wartime services the editors of STEEL developed this past year. They are part of a complete information service for the metalproducing and metalworking industries which is truly a "direct line of communication between government and industry" and equally or even more important—a pooling of industry's information for the common use of all.

And so, as we get on with the biggest job ever faced by any of us, the entire staff wants to express their warm appreciation for your loyalty, as one of STEEL's many readers of long standing; and for your interest and enthusiasm if one of the several thousand new readers who have recently begun to use STEEL for the first time.

A Happy and Victorious New Year!

Vol. 112, No. 1, January 4, 1943, issue of STEEL, published every Monday at Cleveland, Ohio. Entered as second class matter at the post office, Cleveland, O., under act of March 3, 1879. U. S. and possessions, Canada, Mexico, Cuba, Central and South America, 1 year $6; 2 years $10; all other countries, 1 year $12. Current issues, 25c. Yearbook of Industry issue, $2.00.

Editorial Contents—Page 185

"A HOBART welder is packed jam full of... SPEED!"

by don herald

One reason America is now turning out tanks and ships as fast as flapjacks is . . . Hobart Arc Welders.

These Hobart babies are built to give swift, uninterrupted flow of welding juice . . . without hems, haws, hitches, halts or hang-ups. No wonder they're known in the trade as the ace "sewing machines of steel."

With the new, handy, dandy, Hobart and its 1000 combinations of voltage and welding current, it is possible to get new welding speed, new high quality welds, new convenience for the operator—and to take full advantage of the new coated electrodes.

Don't weld an inch until you see how Hobart can cut costs and step up production for you.

HOBART BROTHERS CO.
BOX ST-13, TROY, OHIO

Awarded to Hobart Brothers for Excellence in War Production

7 OTHER THINGS TO LOOK FOR in arc welders, to which HOBART always "measures up."

HOBART "Simplified" **ARC WELDING**

with the exclusive and original REMOTE control

HOBART BROS. CO., Box ST-13, TROY, OHIO

I'm interested in "Speed" for my production. Tell me more about Hobart Welders.

☐ Send Catalog ☐ Send _____ books. "Practical Arc Welding" at $2.00 ea. Answers many a welding problem.

NAME _____

FIRM _____

ADDRESS _____

"One of the World's Largest Builders of Arc Welders."

CINCINNATI

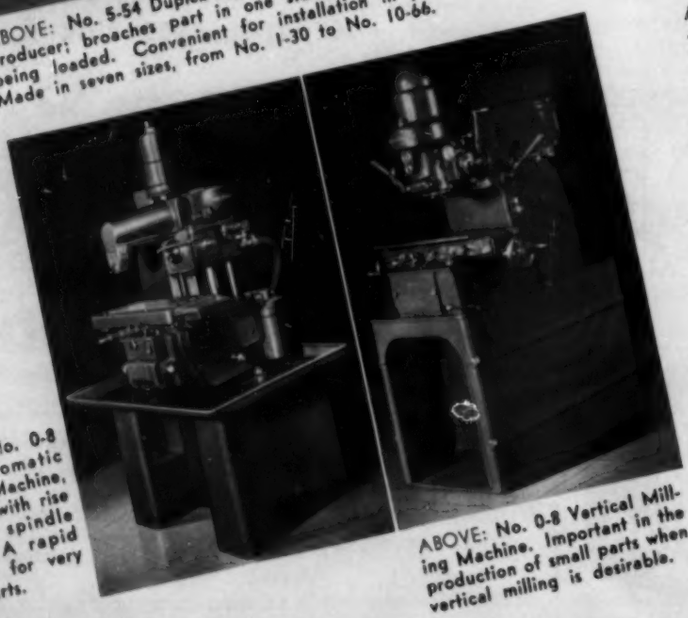
FOR RAPID PRODUCTION

PATENT NOTICE — The machines illustrated and described on these pages are manufactured under and protected by issued and pending United States and Foreign Patents.

PRODUCTION of parts for war materiel and essential civilian items can be often speeded up by replacing old shop equipment with new machines, with automatic machines, by employing more intensive tooling, new production methods. Perhaps in your own shop you can find many such opportunities for increasing production per unit of man power and factory space. In the fields of milling, grinding, broaching, lapping, die sinking, and cutter sharpening, look to CINCINNATI for more efficient machine tools and more dependable Engineering Service.

ABOVE: No. 5-54 Duplex Hydro-Broach Machine. A continuous producer; broaches part in one station while other station is being loaded. Convenient for installation in production line. Made in seven sizes, from No. 1-30 to No. 10-66.

ABOVE: 12" Hydraulic Universal Grinding Machine. Raises tool room and job shop grinding to a new level of accuracy and production. Made in 24", 36", 48", and 72" lengths.



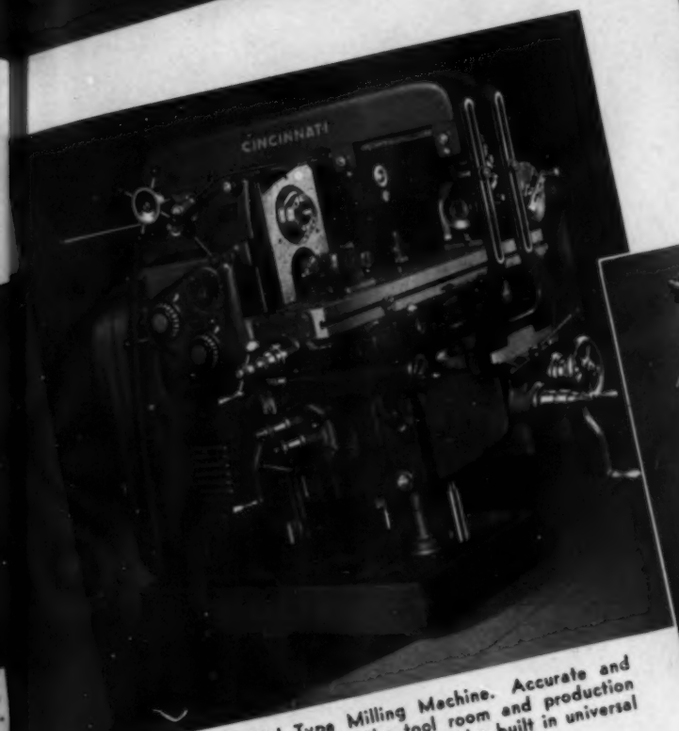
RIGHT: No. 0-8 Plain Automatic Milling Machine, equipped with rise and fall spindle carrier. A rapid producer for very small parts.

ABOVE: No. 0-8 Vertical Milling Machine. Important in the production of small parts when vertical milling is desirable.

ABOVE: No. 1-18 Plain Automatic Milling Machine. For shops where high production of small parts is an important factor.

OF War Materiel

WITH AN EYE TO LOW COSTS



ABOVE: Dial Type Milling Machine. Accurate and productive millers for the tool room and production shop. Plain machine illustrated. Also built in universal and vertical styles, Nos. 2, 3 and 4 size.

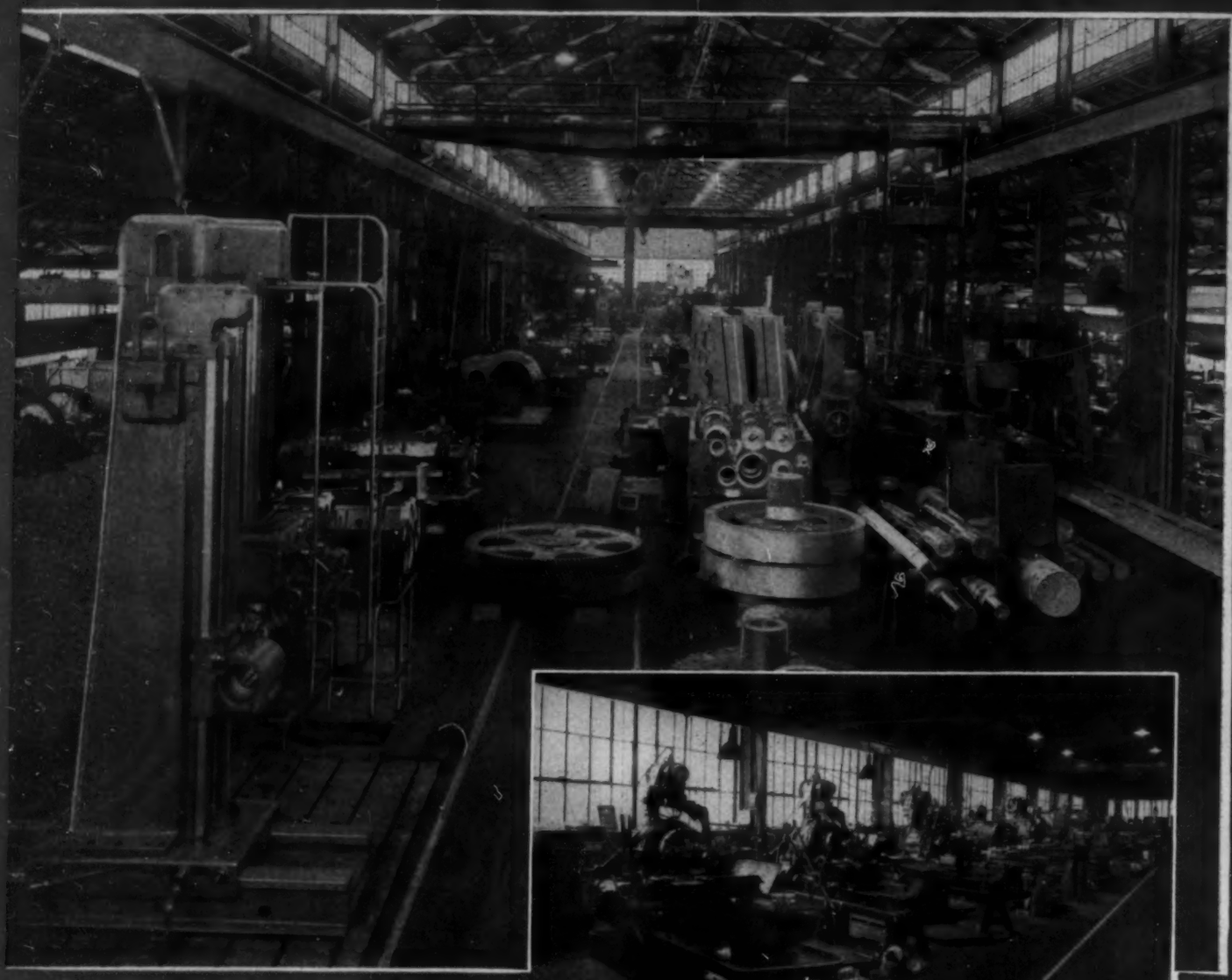
LEFT: No. 2. Centerless Grinding Machine. Slashes grinding costs on a host of parts; steel, rubber, plastics, glass, etc. Economical for rather small lots, too.

Plain Hydromatic Milling Machine. For the heavy jobs run in medium or large quantity production. Made in plain and duplex styles, 18 sizes of each.

No. 2-24 Plain Automatic Milling Machine with Hydraulic Rise and Fall Mechanism for the Spindle Carrier.

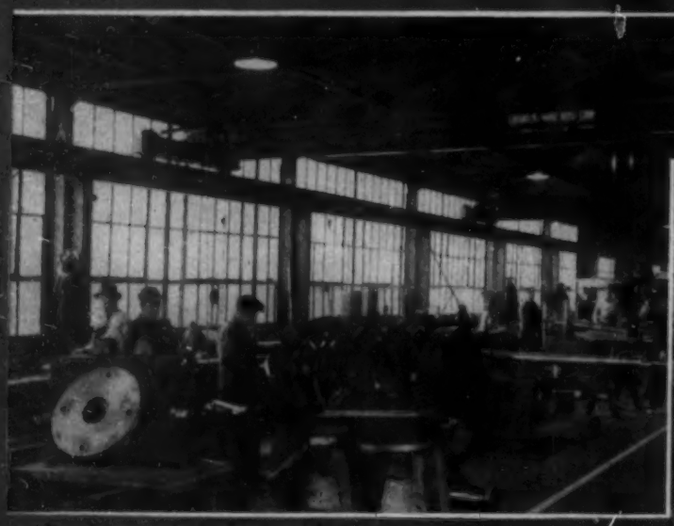
MACHINES . . . CENTERTYPE GRINDING MACHINES . . . CENTERLESS GRINDING MACHINES . . . CENTERLESS LAPPING MACHINES

The Plant Behind The Product—



View of central aisle, main plant

Section of Side Bay



Section of Sub-Assembly Dept.

Section of Main Assembly Dept.

THOMAS

Steel Fabricating EQUIPMENT

designed to meet today's vital needs

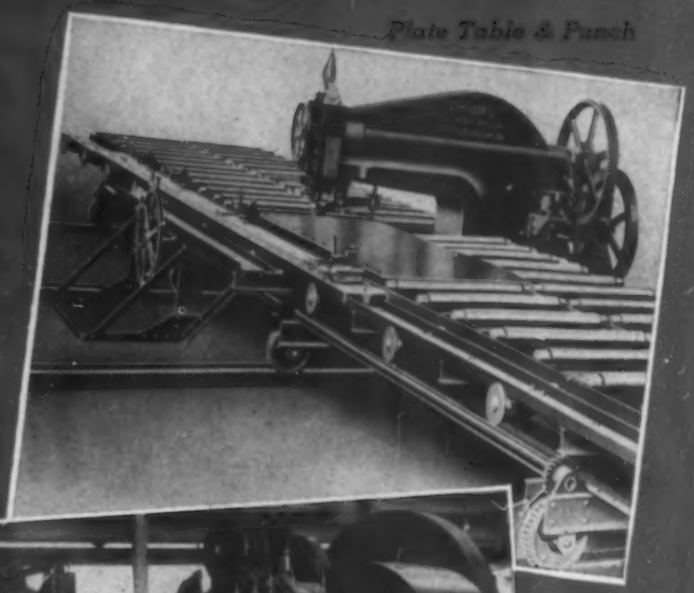
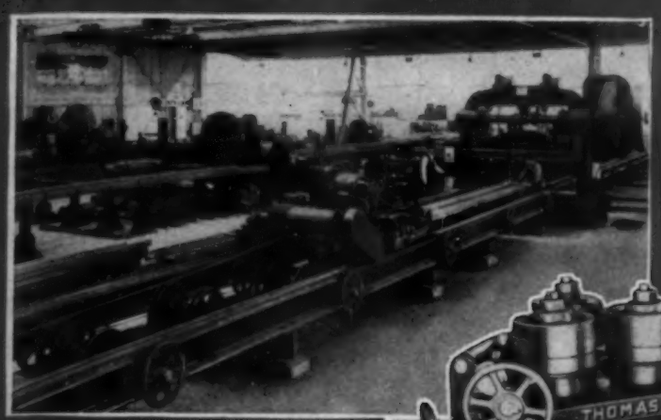


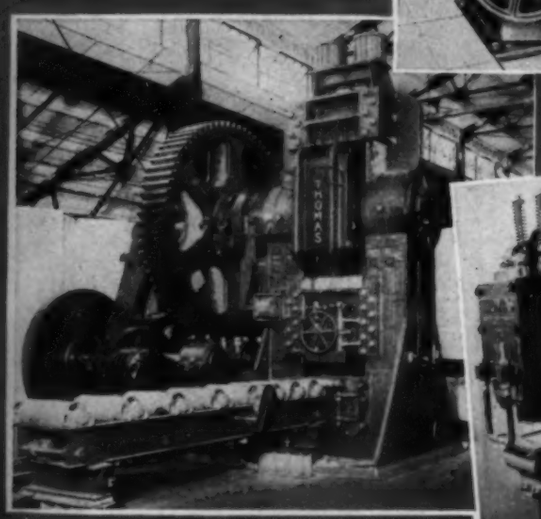
Plate Table & Punch



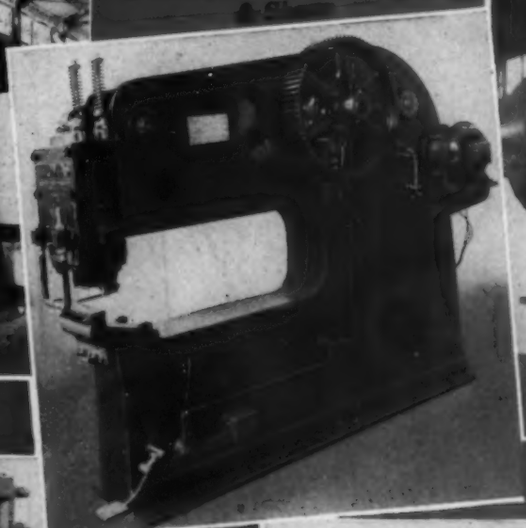
Automatic Spacing Table & Multiple Punch

Angle Shear

Angle Bender



Standard Open Type Punch & Shear



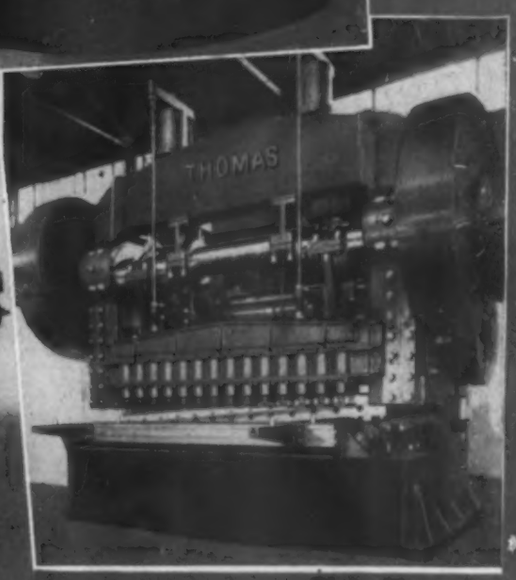
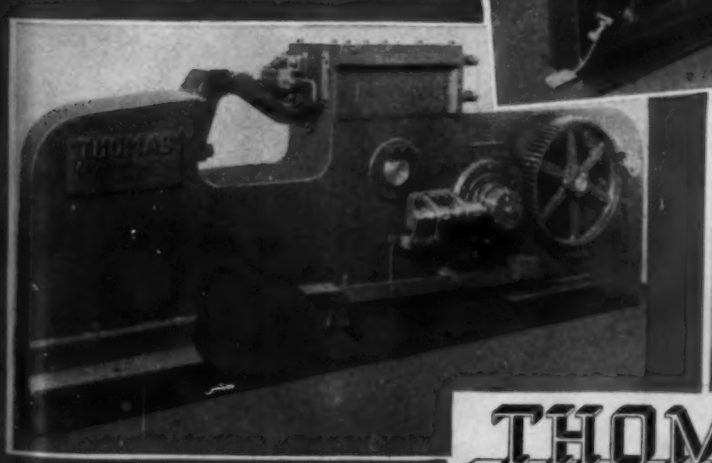
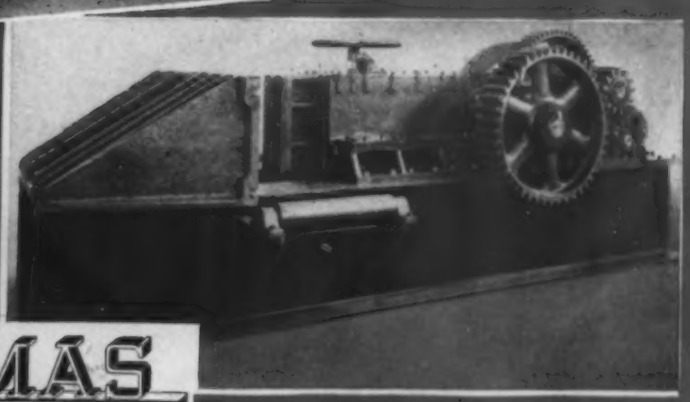


Plate Shear

Bulldog Shear

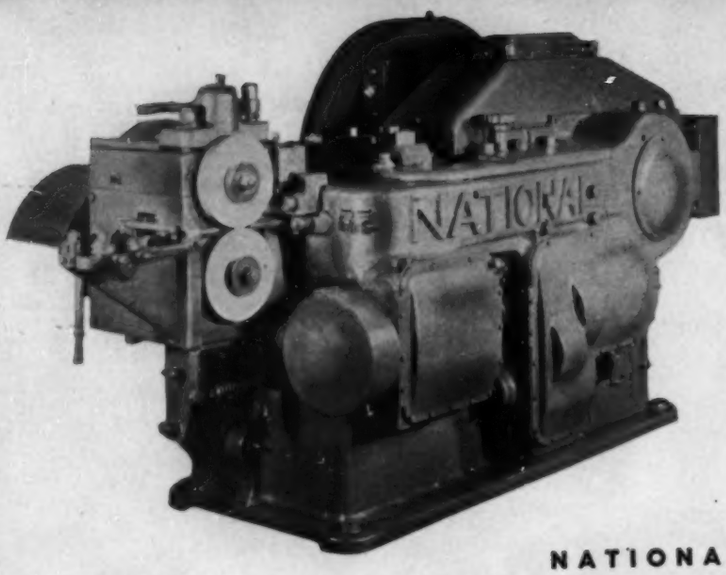


Horizontal Punch

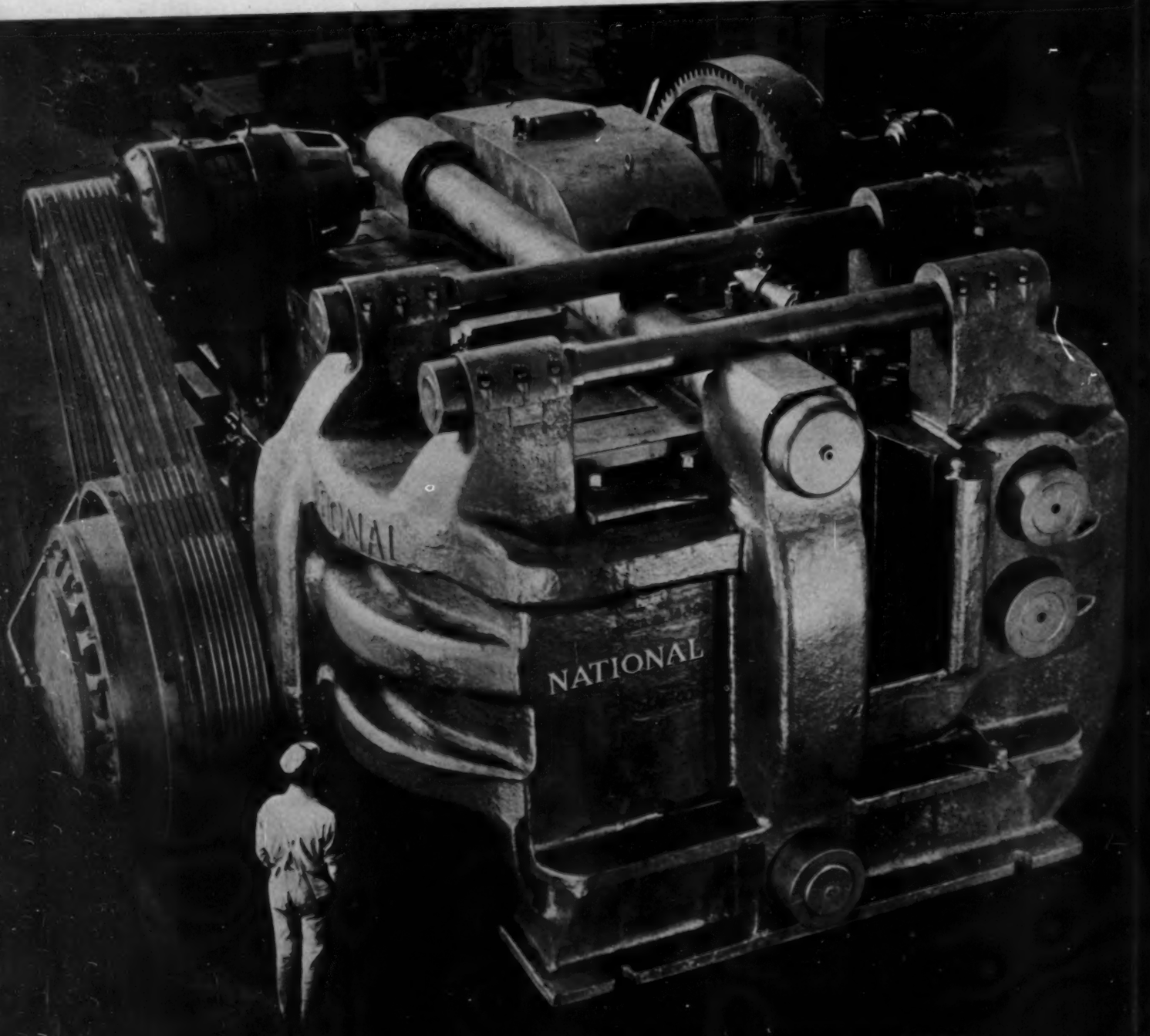


Bending and Straightening Machine

THOMAS
MACHINE MANUFACTURING COMPANY
PITTSBURGH, PA.



NATIONAL COLD HEADER



NATIONAL HIGH DUTY FORGING MACHINE

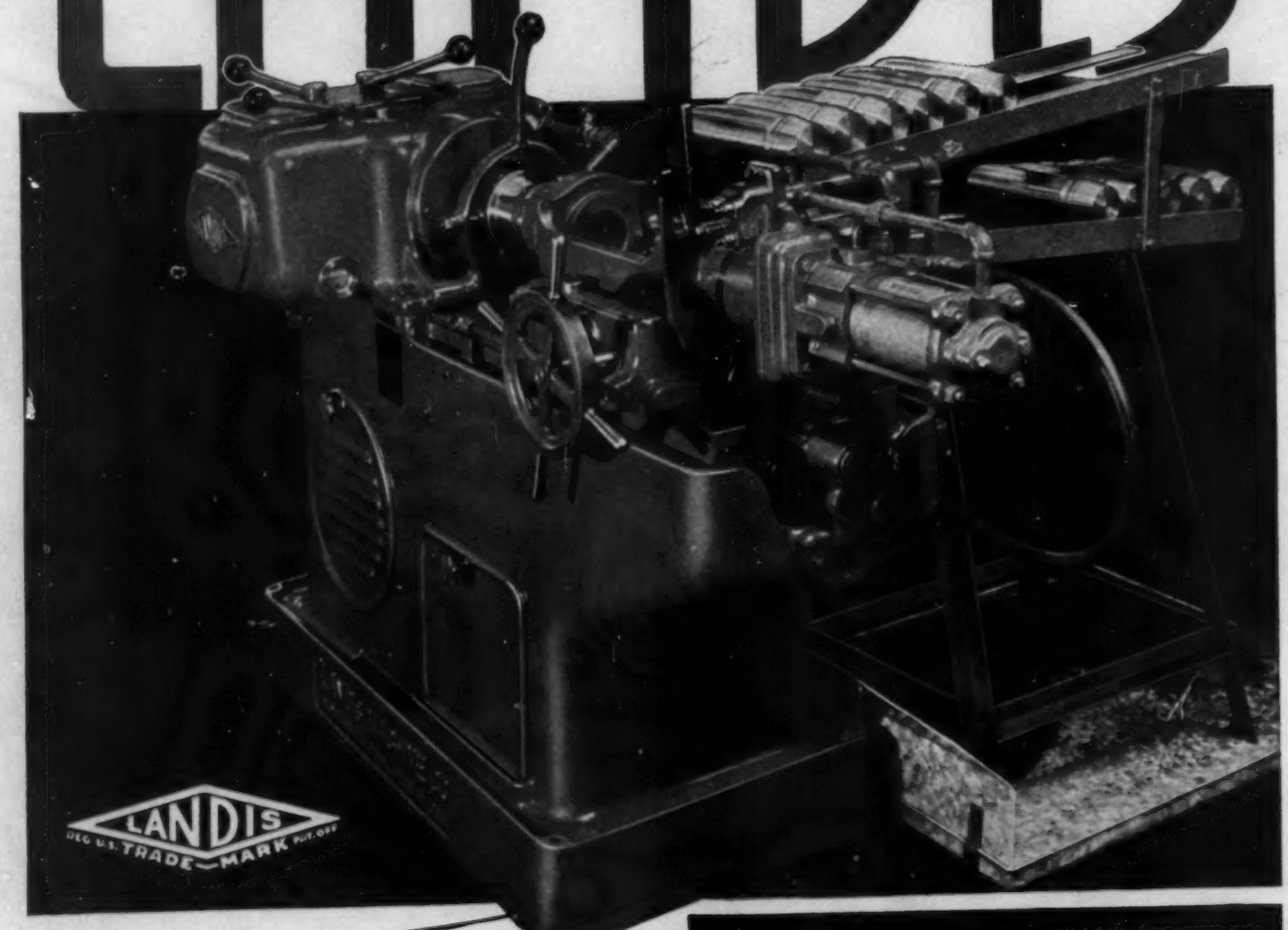
NATIONAL MACHINERY COMPANY is Speeding Victory with these three Vital Contributions to U. S. War Production

National Forging Machines, Maxipresses and Headers (hot and cold) are "in there pitching"—producing hundreds of forged items in use on our fighting fronts. Ships, planes, tanks, trucks, guns and shells all contain many essential strength-contributing forged parts made by these versatile machines.

The NATIONAL MACHINERY CO.
TIFFIN, OHIO, U. S. A.

NATIONAL FORGING MAXIPRES

LANDIS



The LANDIS LINE

THREAD CUTTING MACHINES
- Landmaco Threading Machines
- Bolt Factory Threaders
- Automatic Forming and Threading Machines
- 4 Spindle Semi-Automatic Threading Machines
- Pipe and Nipple Threading Machines

THREAD CUTTING DIE HEADS
- Landmatic (for Turret Lathes and Screw Machines)
- Landex (for Automatic Screw Machines)
- Lanco (for Automatic, Semi-Automatic and Hand-Operated Threading Machines)
- Lanco Pipe and Nipple Threading Heads
- Stationary Pipe Die Heads
- Reverse Taper Die Heads
- Standard Rotary Die Heads

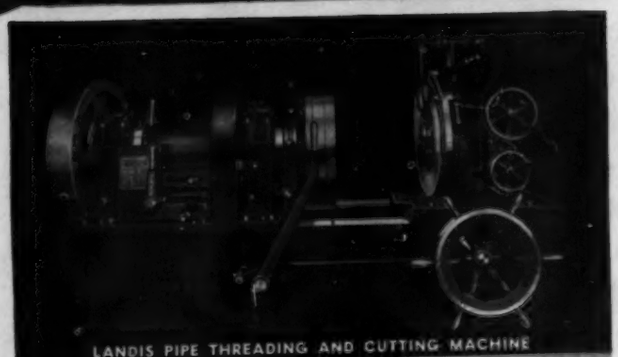
PRECISION THREAD GRINDERS

PIPE THREADING AND CUTTING MACHINES

ROLLER PIPE CUTTERS

CHASER GRINDERS

COLLAPSIBLE AND ADJUSTABLE TAPS



LANDIS PIPE THREADING AND CUTTING MACHINE

Write for the Booklet
"BE THREADWISE"

Production Line for 1943

THE LANDIS CHASER

In 1943, as in 1942, Landis Machines and Equipment will set the pace in Threading for War Production. During the past year, our Engineers have developed new threading equipment that has greatly increased threading production for many industries. Let us tell you about it.

THE LANDMATIC HEAD

LANDIS LT COLLAPSIBLE TAP

THE LANCO HEAD

LANDMACO THREADING MACHINE

LANDIS ⅜" THREADING MACHINE

LITTLE LANDIS THREADING MACHINE

LANDIS MACHINE COMPANY

WAYNESBORO · PENNA · U·S·A·

NOW AVAILABLE IN 150-TON CAPACITY

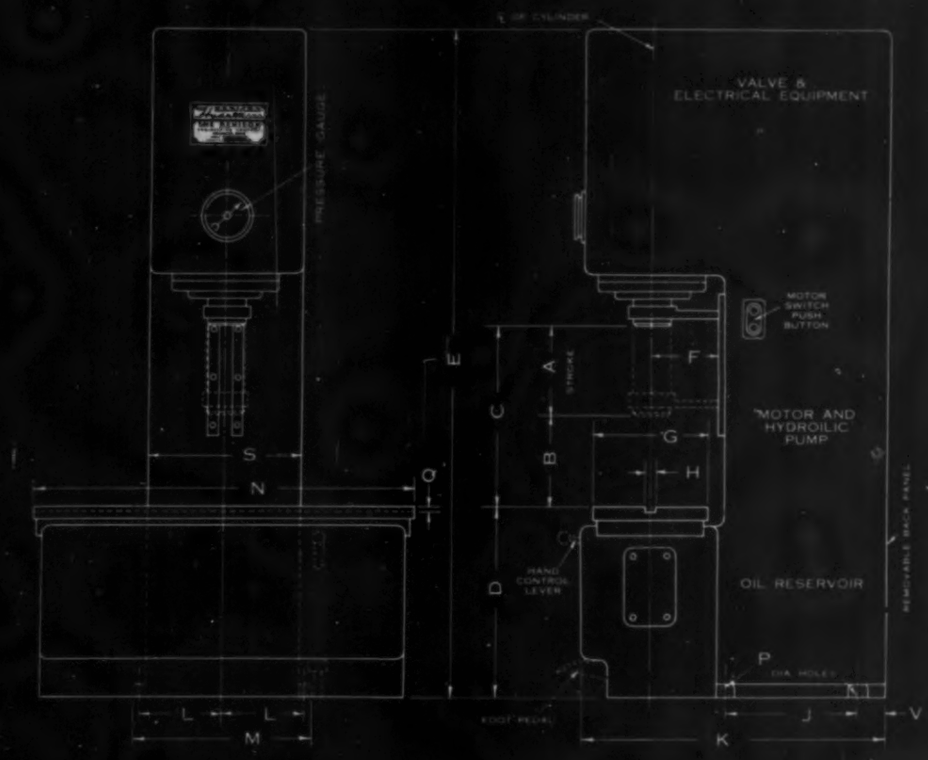
HydrOILic Press

for 15 to 150-ton straightening and assembling DLSC2-150

Better results have been gained on so many war-production jobs with Denison's oil-hydraulic DLSC2 presses that a similar unit for heavier work has been demanded. So now a 150-ton unit—the DLSC2-150—has been added to the line.

INDUSTRY'S NEW RIGHT HAND FOR PRESSING

The **DENISON** Engineering Co.



SPECIFICATIONS

	DLSC2 150
MAXIMUM WORKING CAPACITY—TONS	150
CYLINDER BORE INCHES	14
RAM SPEED, DOWN (RAPID TRAVERSE) F.P.M.	78
RAM SPEED, DOWN (HIGH PRESSURE) F.P.M.	1
RAM SPEED, UP F.P.M.	20
PUMP VOLUME GALLONS PER MIN.	62
MAXIMUM WORKING PRESSURE P.S.I.	2000
MOTOR H.P. 1200 R.P.M.	15
RAM DIAMETER INCHES	11
RAM THREAD FEMALE, SIZE, PITCH	4-12
OIL RESERVOIR CAPACITY-GALLONS	110

DIMENSIONS

	DLSC2-150
A	12
B	30
C	42
D	36
E	133
F	20
G	28
H	1
J	40
K	85½
L	19
M	41
N	66
P	1⅛
Q	½
S	34
V	6

HydrOILic STRAIGHTENING PRESS

CAPACITY 150-TONS

MANUAL CONTROLS

MAX. WORKING PRESSURE 2000 P.S.I.

MAXIMUM STROKE: 12"

MAX. THROAT OPENING: 20"

MAX. VERTICAL OPENING 42"

FEATURES

Exact tonnage required for each task is obtained without adjustments . . . because the ram movement and pressure are both precision-controlled by means of the hand lever or footpedal. (Yet stroke and pressure limits can be set, if desired.) Release of the control lever returns the ram to the full-daylight or pre-set opening *at once* . . . and positive locking prevents "drift." DLSC2-150 is a fully-enclosed, self-contained press in a streamlined frame, with ample toe-space for safe, easy access to the work-area. Maximum stroke —12 inches. Maximum vertical opening—42 inches. Also available in 25, 50, and 100-ton capacities. Write for complete information.

OPERATION

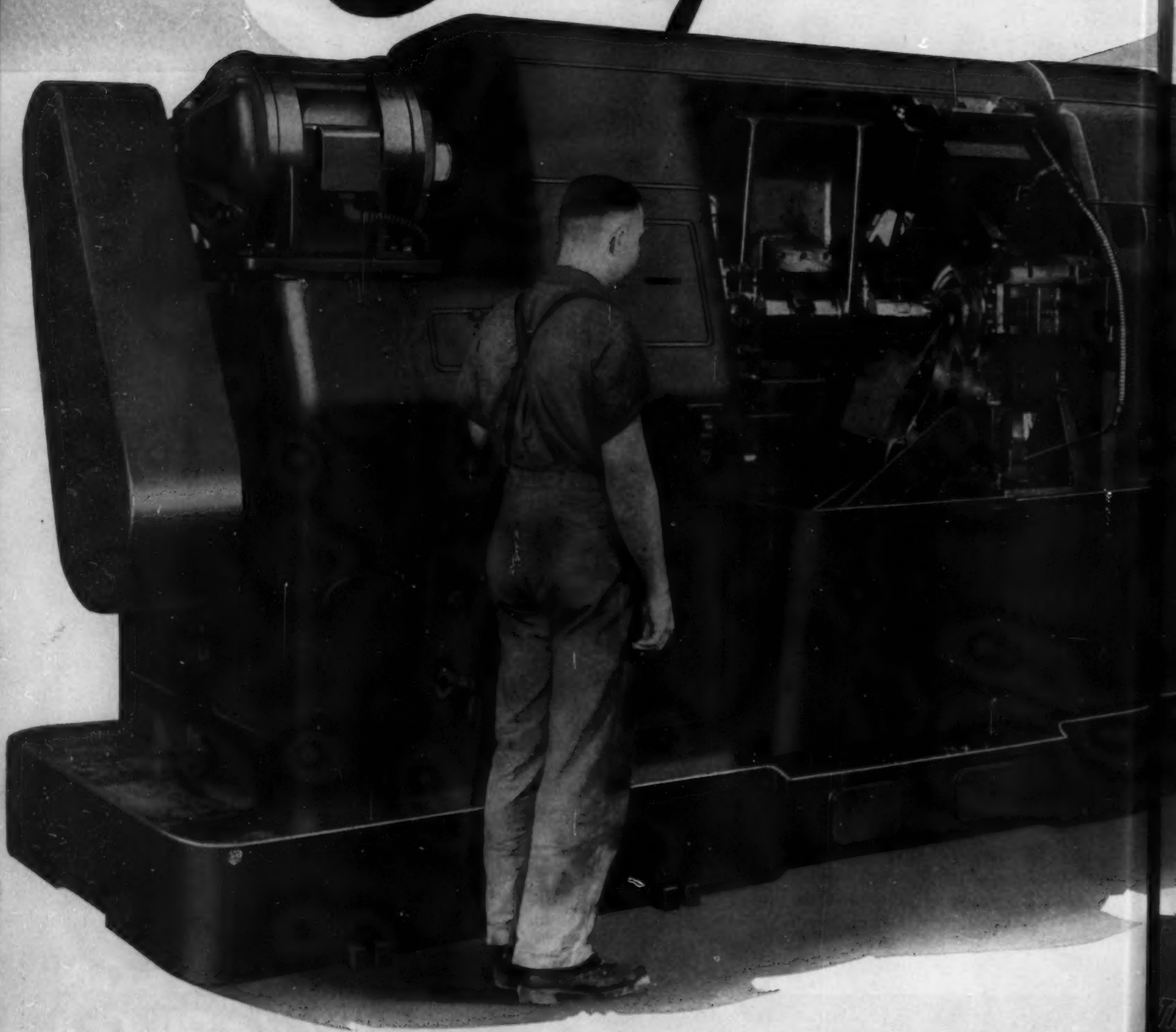
Operation is extremely simple. The ram is held in place hydraulically when it reaches the upper stroke limit, and the pump and motor idle, using minimum horsepower. Downward movement of the control lever causes the ram to move downward at rapid traverse speed exerting minimum tonnage, until it contacts the work. Further downward movement of the control lever increases the tonnage in direct proportion to the pressure exerted on the lever. Upon release of the control lever the ram returns immediately to the pre-set upper stroke limit, or to the full-daylight opening. All principal moving parts operate in a bath of oil, reducing wear and maintenance costs.

THIS FREE BULLETIN may point the way to better results on many assembling, straightening and bending operations in your plant. It contains full details on the Denison line of HydrOILic Presses —plus 12 pages of engineering tables. Write for your copy today!

DENISON
EQUIPMENT for APPLIED
HydrOILics

1163 Dublin Road Columbus, Ohio

THE 8 INCH SPINDLE CAPACITY Acme-Gridley



LENGTH 14'6" • WIDTH 5'7" • HEIGHT 8' • WEIGHT 70,000 Lbs.

HEIGHT TO CENTER TOOLING ZONE - - 4'6"

LARGEST MULTIPLE SPINDLE AUTOMATIC INCREASES OUTPUT *Ten Times!*

A WAR ASSIGNMENT—AGAINST TIME

With total war came the jump—demand from hundreds to thousands of airplane motors and tanks per month. These require precision parts of large diameter and on schedules that single spindle methods could not possibly meet.

Our Government said "Build 8 inch Acme-Gridley 4 Spindle Automatics for these parts manufacturers; apply your experience, skill, plant facilities — and lose no time."

In less than 5 months we designed, built, tooled and delivered the first machine to customer's plant. Immediately and without makeshift it was pronounced "running to perfection" and PRODUCING THE JOB 10 TIMES FASTER THAN HAD BEEN POSSIBLE BY THE FASTEST SINGLE SPINDLE METHOD PREVIOUSLY USED.

The record time from design to delivery included our building jigs, fixtures for complete interchangeability of tooling and parts. And continued deliveries of many more of these 35 ton giant multiples have not interrupted our production of the hundreds of six spindle Acme-Gridley munition automatics in other sizes on war schedules.

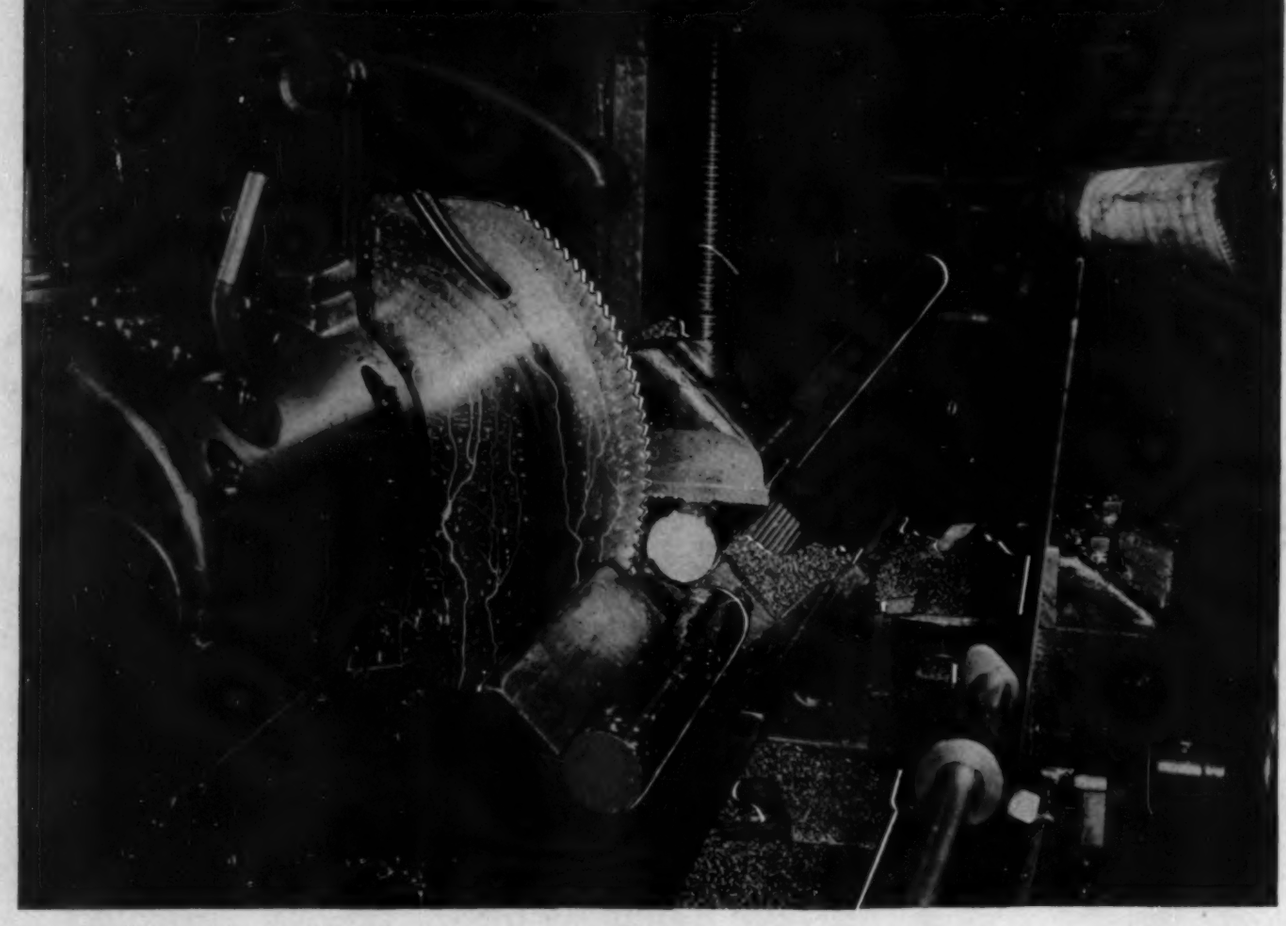
We are proud to have fulfilled this, our special war assignment, on time and *in* time.

THE NATIONAL ACME CO.

170 EAST 131ST STREET • CLEVELAND, OHIO

ACME-GRIDLEY 4-6 AND 8 SPINDLE BAR AND CHUCKING AUTOMATICS • SINGLE SPINDLE AUTOMATICS • AUTOMATIC THREADING DIES AND TAPS • SCREW MACHINE PRODUCTS • THE CHRONOLOG • LIMIT SWITCHES • SOLENOIDS • POSITIVE CENTRIFUGE • CONTRACT MANUFACTURING

ATKINS *Curled-Chip* SAWS



Best for War Work Because They

TAKE LESS TIME FOR "TIME-OUT"

● The production loss caused by tool change-overs is one of those "necessary evils" that plague war plant production managers. It is no wonder, then, that Atkins Curled-Chip Saws have come as a god-send to shops and factories hard pressed for more and more output.

The capacity of these saws for sustained cutting without re-sharpening is tremendous. On armor plate, copper, brass, aluminum, iron, steel or any other metal, curled-chip teeth are on record as cutting double, triple and even more material between saw change-overs. In addition they take a deeper bite of metal than was practical hitherto, cutting with greater accuracy on shell stock, shell bands, gun mounts and many other armament parts.

For full data on these production-boosting saws, write for information on Atkins Engineered Cutting Service.

E. C. ATKINS AND COMPANY
406 S. Illinois St., Indianapolis, Indiana

ORIGINATORS OF THE *Curled-Chip* SYSTEM OF METAL CUTTING

Plan for a Long War— Work for a Short One!

No one can say how long this war will last. But maintenance can say how long America's *motors* will last... and how efficiently they will work to help *shorten* the war!

MAINTENANCE "as usual" went out with Pearl Harbor. Today, every U. S. maintenance man knows he's pitted against a Jap or Nazi maintenance man. He's got a man-sized job...

For example, if the current in a motor exceeds its nameplate current rating, heating may increase as much as the *square* of the current increase! And when a motor runs a fever, there's trouble ahead...

Excessive heat can "fry" the life out of insulation, melt soldered connections, burn out bearings. That's why a close eye must be kept on every motor's overload protection.

Friction is another dangerous source of heat — so the right lubricant in the right amount must be kept *in* bearings and dust must be kept *out!* For cool-running motors, dust must be kept out of *windings*, too...

If compressed air or suction doesn't get the dust out, it's necessary to give the dirty motor a "bath". *Promptly*, too — because the rim travel of a rotor in many motors today is round the world *every eight days*...

Some job to keep motors rolling at that rate — for the duration!

Just as "rutting" is fought in road maintenance, "grooving" must be fought in *motor* maintenance. Some wear is inevitable on slip rings and commutators, of course. But *smooth and even* wear is *slow* wear!

"Keep oil where it belongs" is a basic rule in maintenance. Once outside bearings, it attacks any insulation it reaches. *Inside* bearings, oil must be protected against misalignment pressures...

The oil film guarding a bearing often is no thicker than the wall of a soap bubble... can fail just as suddenly — *and completely!*

For the full story of what *today's* maintenance should be, send for your free copy of "A Guide to Wartime Care of Electric Motors." It's fully illustrated (with the sketches above and many more), practical, complete. ALLIS-CHALMERS MFG. CO., MILWAUKEE, WISCONSIN.

A 1553

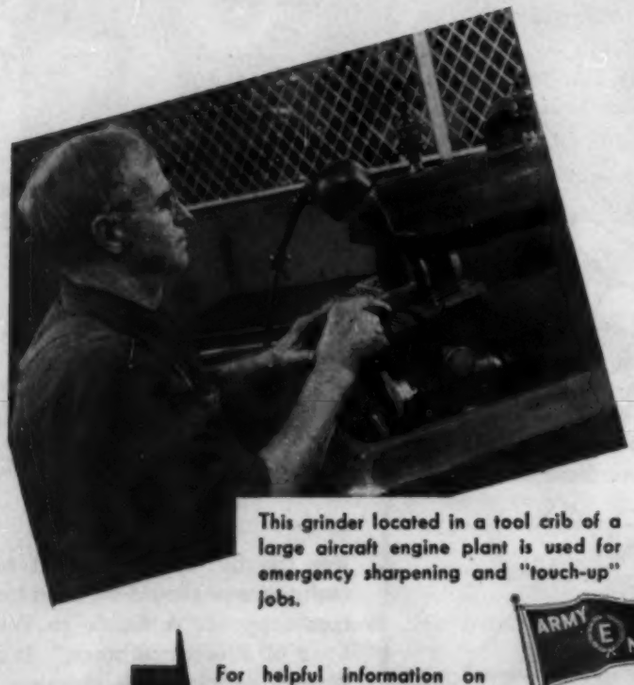
ALLIS-CHALMERS

WE WORK FOR VICTORY WE PLAN FOR PEACE

Tool Conservation begins in the Tool Crib

This Tool Sharpening Department under the supervision of an experienced tool engineer assures that every tool in the plant's cribs is in excellent condition.

GET ALL THE *Good* OUT OF *Good Taps*



This grinder located in a tool crib of a large aircraft engine plant is used for emergency sharpening and "touch-up" jobs.

Maintenance of tools in proper working condition multiplies their life many times. Even those which have become badly worn, rusted or chipped — that seem to have outlived their usefulness — may often be salvaged to give valuable additional service.

Many large plants maintain separate tool sharpening and salvage departments. But the small shop or departmental tool crib may easily do an outstanding job if equipped with a small grinder and a few attachments.

• • •

For helpful information on how to keep taps at peak efficiency, send for *"Greenfield's"* new booklet, "How To Sharpen A Tap."

GREENFIELD TAP AND DIE CORPORATION
GREENFIELD, MASSACHUSETTS
DETROIT PLANT: 5850 Second Boulevard
WAREHOUSES in New York, Chicago and Los Angeles
In Canada:
GREENFIELD TAP AND DIE CORP. OF CANADA, LTD., GALT, ONT.

ARMY E NAVY

GTD GREENFIELD

TAPS · · · · · DIES · · · · · GAGES · · · · · TWIST DRILLS · · · · · SCREW PLATES

A new year ... a renewed faith

BEFORE us lies a new twelve months . . . a milestone in history which, we hope, will guide us to a fuller realization of America's way of life.

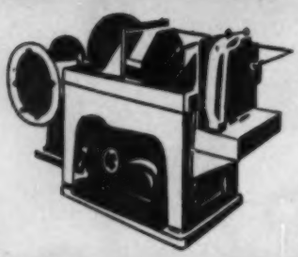
And to the extent that manpower and machinery and munitions co-ordinate, to that extent will the path to Victory be made secure.

Latrobe, in line with Industry everywhere, dedicates this coming year to a renewed faith in American ideals and a renewed effort to maintain maximum production. Backed by traditional quality, Latrobe's trademark symbolizes in the months that lie ahead, as it has in the past, dependable tool steels for the essential tools of Victory!

HIGH-SPEED STEELS
FOR THE
TOOLS OF VICTORY

LATROBE
ELECTRIC STEEL COMPANY
LATROBE • • • PENNSYLVANIA

Specify STANDARD MACHINERY CO.
METAL FORMING EQUIPMENT

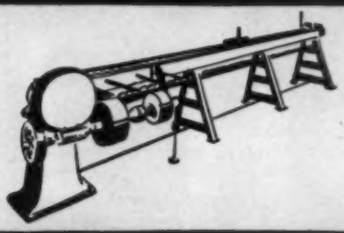


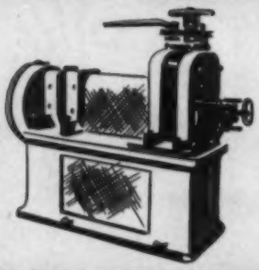
TURKS HEADS ADJUSTABLE DRAWPLATES

Adjustable draw plates—accepted by wire trade as accurate, efficient means of producing rectangular and special shapes. With friction or power driven rolls. Catalog TH.

DRAW BENCHES ONE MAN TYPE

8 sizes, 2 general types. Machines are of one-man type with all controls at die end. Catalog DB.



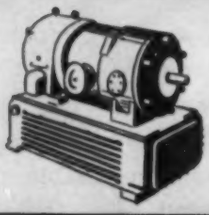


ROLLING MILLS STRIP AND WIRE

Roller bearing and plain bearing mills; many regular sizes or made to suit user's specific needs. Write fully.

SWAGING MACHINES ROTARY TYPE

For reducing diameter of tubular and solid bar stock into cylindrical, conical, or "necked" shapes. Capacities from ½" tube, ¼" solid to 6" tube or 3¾" solid. Catalog SM.



AND THE **NEW** *STANDARD FLUID DRIVE*

Suitable for variable speed or controlled torque drive applications. Also suitable for high pressure pumping of fluids.

Write for Complete Information

STANDARD MACHINERY CO.
PROVIDENCE RHODE ISLAND

When You Order HACK SAW BLADES Specify

"Made of INGERSOLL *D-B-L"

(TUNGSTEN.....5.00—6.00
MOLYBDENUM...4.00—5.00)

*Produced by Ingersoll for the past 4 years under an exclusive license arrangement with Allegheny-Ludlum Steel Corporation.

That's the Way You Can Be Sure of Getting D-B-L backed by 4 Years' Manufacturing Experience

Ingersoll D-B-L is the lower cost type of High Speed Steel that has so successfully solved the Hack Saw Blade problem for America's record wartime production.

Four years ago, Ingersoll began to produce D-B-L Steel for Hack Saw Blades. So successful was this product that many Hack Saw Blade users adopted it long before wartime restrictions curtailed the use of vital alloys.

The remarkable performance of Ingersoll D-B-L . . . its relative freedom from decarburization . . . its tough cutting quality and its high impact resistance . . . plus its lower cost, have made it a wartime favorite. Specify *Ingersoll* D-B-L, on its 4-year record of past performance.

INGERSOLL STEEL & DISC DIVISION
BORG-WARNER CORPORATION
New Castle, Indiana
Plants: New Castle, Ind.; Chicago, Ill.; Kalamazoo, Mich.

Other Special INGERSOLL Sheet Steels include:

Alloy Steels
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Stainless Steels and Saw Steels, including "18-4-1" and Molybdenum and D-B-L Hack Saw Steels

INGERSOLL STEELS

FOR SPECIAL USES

A tribute from the men who fight to Struthers Wells men who make their fighting equipment

There's a common bond of understanding and appreciation of sacrifices between democratic free men, that spells defeat for world terrorists. Struthers Wells . . . to a man . . . accepts with justifiable pride the distinguished Army-Navy "E" Production Award "for high achievement in the production of war equipment."

The overwhelming determination of even greater war production achievement in our plants, is as typically Struthers Wells . . . as the always dependable precision, ingenuity and quality so consistently evidenced in Struthers Wells peacetime production.

TITUSVILLE, PA. **STRUTHERS WELLS CORPORATION** WARREN, PA.

HEAVY PUSH BENCH FOR THE MANUFACTURE OF LARGE SEAMLESS STEEL VESSELS

HYDROPRESS · INC.

ENGINEERS CONTRACTORS

HYDRAULIC PRESSES · ROLLING MILLS
PUMPS · ACCUMULATORS

570 LEXINGTON AVENUE • NEW YORK • N. Y.

CLECO TOOLS

RIVETING HAMMERS

For heavy duty work with hot rivets. Three styles of handles. Write for Bulletin 82.

CHIPPING HAMMERS

47 sizes and styles for chipping, caulking, beading and scaling. Write for Bulletin 75A.

ROTARY DRILLS

For all kinds of drilling, reaming, tapping, nut setting and screw driving. Bulletin 83.

SAND RAMMERS

A model for every moulding job — for floor, flask, bench and core work. Bulletin 76A.

★ CLECO TOOLS meet today's demand for faster, better production, as well as saving air and reducing maintenance costs. Available in a wide variety of sizes and styles—there is a Cleco Tool for *every* job. All the accessories, too—Bowes couplings, valves, hose, etc. *Write for Bulletins. Also ask for Cleco Cartoons —they tell you how to get better service from your tools.*

ROTARY GRINDERS

35 sizes and types for all kinds of light and heavy grinding. Ask for Bulletin 80.

SQUEEZERS

Model 41-L shown has parallel jaw action, preventing misalignment or loss of rivets. Bulletin 82.

SMALL RIVETERS

For aircraft work. "Slow" and "fast" hitters, with many styles of handles. Bulletin 85.

SHEET HOLDERS

They offer the best method of holding metal sheets together prior to riveting. Bulletin 87.

THE CLEVELAND PNEUMATIC TOOL CO.

3781 EAST 77th STREET CLEVELAND, OHIO

WHERE SHAFTS ROTATE
There Is Friction

REDUCE FRICTION WITH
N·B·M "TIGER" BRONZE AND "REX" BABBITT METAL

EVERY manufacturer is seeking means to keep his machinery going for the duration, with a minimum of repairs. We can help you prolong the life of your bearings.

Bushings and Bars of "TIGER" Bronze are highly anti-frictional because of the even distribution of its ingredients, especially of lead.

"REX" Babbitt Metal contains the highest tin content now generally permitted by government regulations. Properly applied, it will help you keep your machinery in smooth and quiet operation.

Write for our re-babbitting chart and "TIGER" Bronze list showing the hundreds of sizes of cored and solid bars available—rough and machined.

NATIONAL BEARING METALS CORPORATION

ST. LOUIS • NEW YORK

PLANTS IN: ST. LOUIS, MO. • PITTSBURGH, PA. • MEADVILLE, PA. • JERSEY CITY, N. J. • PORTSMOUTH, VA. • ST. PAUL, MINN. • CHICAGO, ILL.

Get 'em in a hurry

Johnson Furnaces

2 WEEKS' DELIVERY

NO. 130 A

Firebox 7 in. high,
13 in. wide,
16½ in. long

For more than 40 years, industry has enjoyed faster, more profitable operation with Johnson Furnaces.

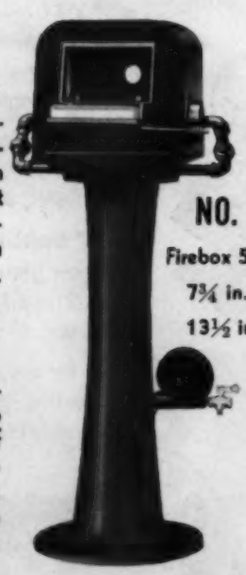
No. 130 A, left, for quick heat-treating hi-speed steels. Counterbalanced door opens upward, allowing tools to be placed in or removed from furnace without fully opening door, thus preventing temperature drops. Carbofrax hearth and ¼ H.P. blower. Lined with insulating refractory. Available with 4 or 6 burners for various temperatures from 1400 degrees to 2400 degrees F. 4-burner job illustrated, $295.00. 6-burner job, $325.00. All prices F.O.B. factory.

NO. 120 HI-SPEED STEEL HEAT-TREATING FURNACE

Exceptionally fine also for hardening dies, tools and punches. Equipped with G. E. motor and Johnson Blower. Heavily lined throughout with insulating refractory. Carbofrax hearth. Temperature regulation easy with air and gas adjustment. $129.50 F.O.B. factory.

NO. 130 HEAT-TREATING FURNACE

Use for quick, high, accurate temperatures for hi-speed steels, also for clean heating of all types of steel. Carbofrax hearth, heavy insulating refractory lining, G. E. motor and extra large Johnson Blower are all standard equipment. $248.00 F.O.B. factory.



NO. 120

Firebox 5 in. high,
7¾ in. wide,
13½ in. long

NO. 130

Firebox 5½ in. high,
13 in. wide,
13½ in. long

JOHNSON GAS APPLIANCE CO.

591 E AVE. NW., CEDAR RAPIDS, IOWA

Engineering Service

for

AMERICA'S

War Industries

Southwark is serving America's war industries through the manufacture of specially engineered equipment and highly developed heavy-duty standard machines designed for a host of diversified applications. With one hundred and six years of experience in the manufacture of industrial machinery, with unsurpassed shop facilities, Southwark is meeting wartime requirements for all types of hydraulic presses, physical testing machines and instruments, rolls, planers, and special machinery—large and small.

Baldwin Southwark Division, The Baldwin Locomotive Works, Philadelphia; Pacific Coast Representative, The Pelton Water Wheel Co., San Francisco, California.

BALDWIN

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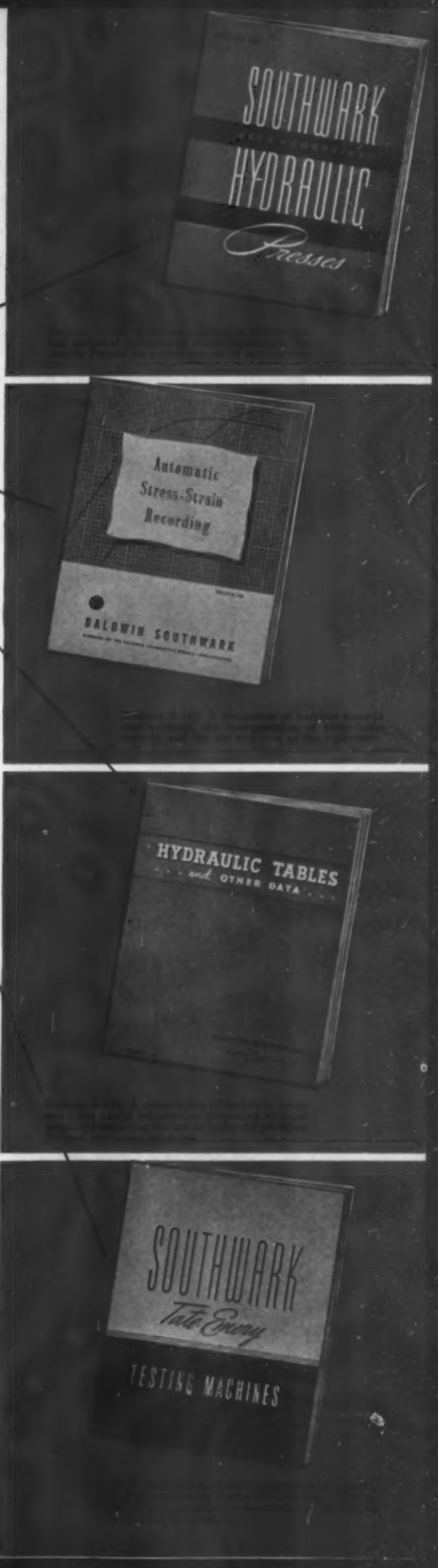
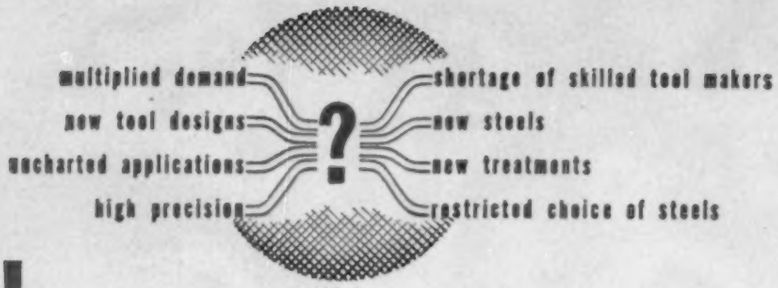
Division THE BALDWIN LOCOMOTIVE WORKS, *Philadelphia, Pa.*





Aid on wartime tool steel problems

Top speed war production demands TOOLS — *more* tools than dreamed of in peace time — *new kinds* of tools for new war time jobs. The tool industry is tackling this tremendous task short of skilled tool makers and restricted by shortages in their choice of steels.

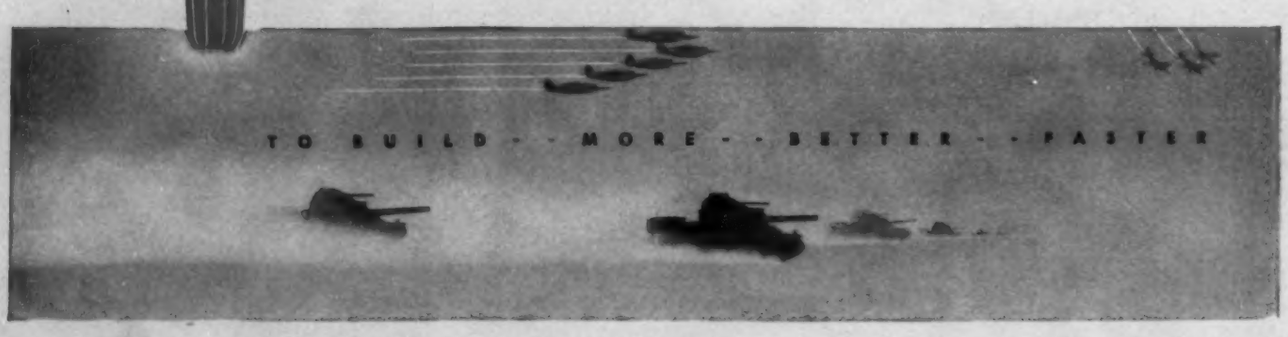
Solutions to these new problems are being worked out every day by the tool industry. Frankly, we don't have all the answers but our contacts with American tool makers determined to win this war puts us in a position to assist you in finding solutions to some of the particular problems that may be facing you.

On your problems of steel selection and treatment of tool steels, we would be very glad to have you get in touch with us. For your convenience, we are listing below the addresses of our district offices.

COPPERWELD STEEL COMPANY · WARREN, OHIO

COPPCO
TOOL STEELS

BUFFALO	1127 Liberty Bank Building	Washington 7283
CHICAGO	122 S. Michigan Avenue	Harrison 1411
CLEVELAND	1158 Union Commerce Building	Cherry 1326
DETROIT	7-251 General Motors Building	Trinity 1-1760
NEW YORK	117 Liberty Street	Cortlandt 7-8314



Cleveland Quality ... Your Assurance of Strength and Accurate Fit in All Cap and Set Screws and Special Upset Parts

SPECIALIZATION in the upset process here at "Cleveland" has brought profitable advantages to users searching for high standards in fasteners. You can get all types of bright full finished, 1035 heat treated and alloy cap screws, and properly case hardened set screws from "Cleveland"—all made by the newest refinements in Kaufman Process procedure. Special upset parts to your specifications. Most sizes of standard items carried in stock at our convenient warehouses. Write for samples and prices.

THE CLEVELAND CAP SCREW COMPANY
2917 East 79th Street • Cleveland, Ohio

1035 and Alloy Heat Treated Cap Screws
Set Screws—All types
Milled Studs—Standard or Special Threads
Special Upset Parts

Cleveland Cap Screws

Set Screws and Special Upset Parts

Made by the Originators of the Kaufman Process for Greater Strength and Accuracy

Specialists for 26 years in Headed and Threaded Products

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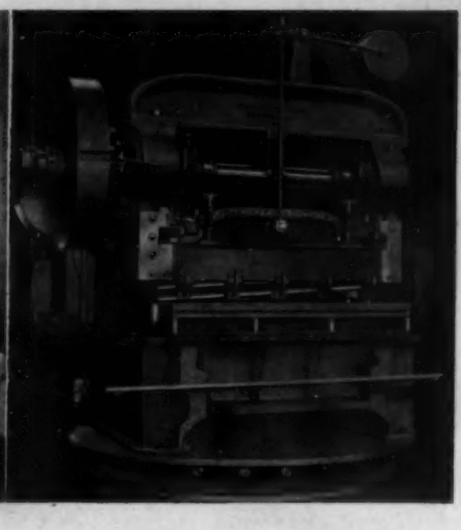
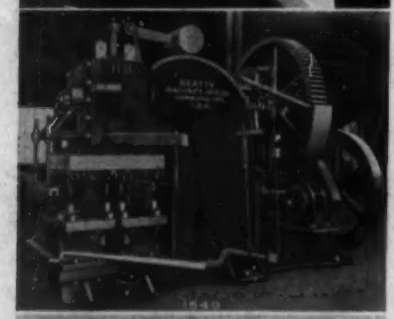
LOS ANGELES: 1015 E. 16th St. . .	**PROS**pect	**8326**

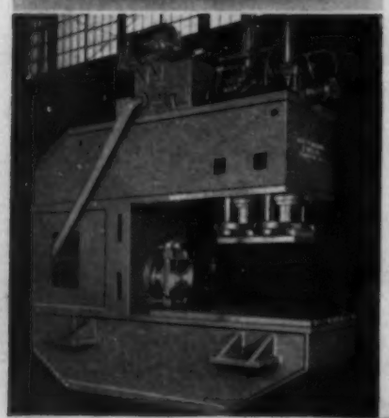


BEATTY

Builders of Heavy Metal Working Equipment



BUILDERS OF HEAVY METAL WORKING TOOLS



When you present any heavy metal working problem to BEATTY for solution, you enlist:

1. First rate engineering minds.
2. Wide experience in solving production problems closely related to your own.
3. Complete facilities for building the exact equipment you need.

You'll find BEATTY designed and built equipment serving important shipyards, railroad shops, aircraft plants and other units in the heavy metal fabricating field. Do YOU have a production problem we might help solve?

Shown at left: The Beatty No. 11 Heavy Duty Punch and the new Hydraulic Flanging Press. These are two items in our complete line of heavy duty punches, shears, coping machines, forcing presses, extruding presses, forming presses, and bulldozers — all designed and built by Beatty engineers for the ship, tank, aircraft, truck, railroad and other heavy metal fabricating industries.

BEATTY MACHINE AND MANUFACTURING CO.
Hammond, Indiana

A VIEW OF OUR TUBE MILL

where we are making
SHELL BANDS AND TUBING
OF COPPER AND GILDING METAL

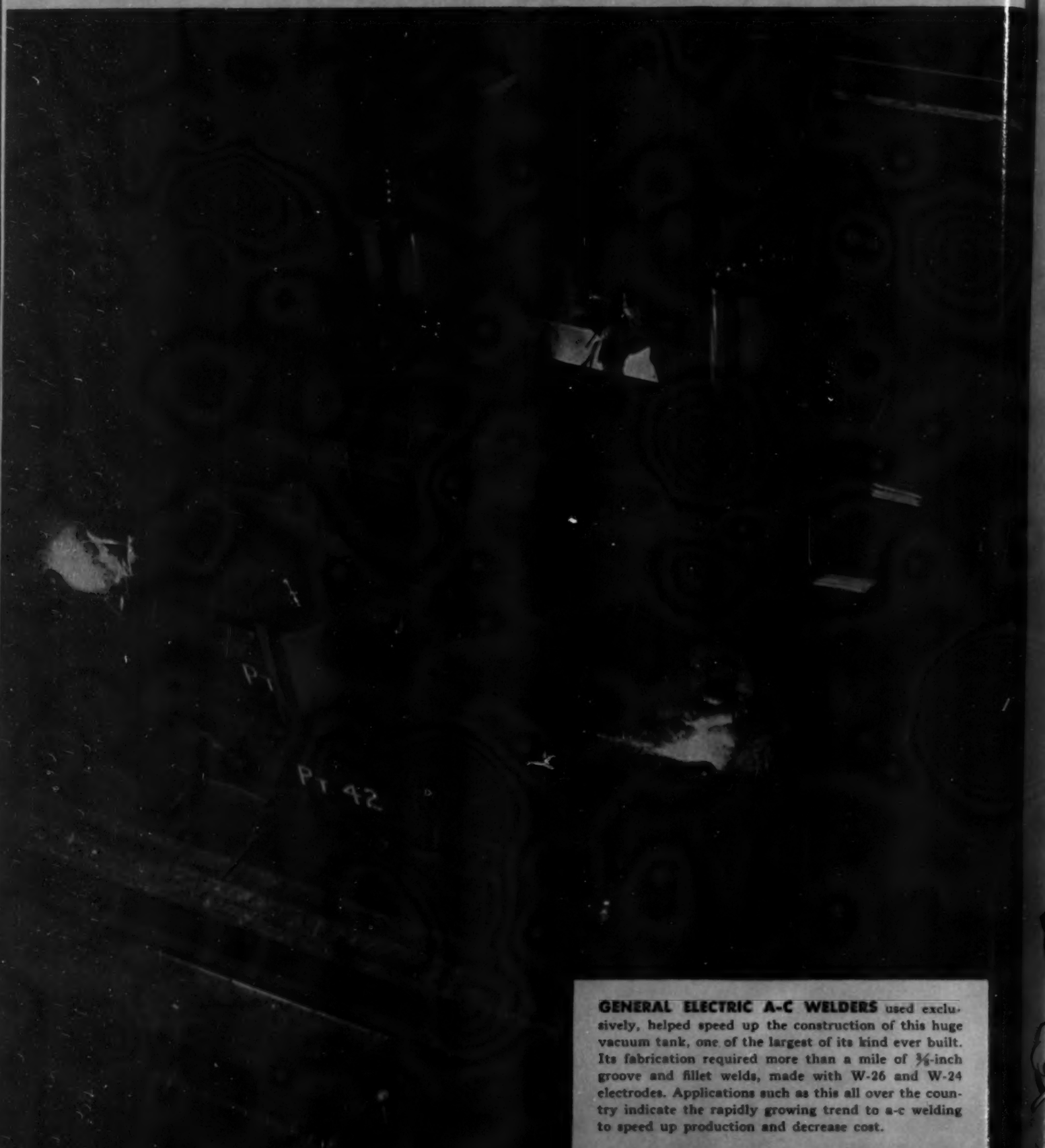
OUR NEW EXTRUSION MILL

will soon be producing
BRASS AND BRONZE RODS
EXTRUDED SHAPES
ALLOY TUBING

LEWIN MATHES

LEWIN-MATHES COMPANY · · SAINT LOUIS, MISSOURI

Want to Increase



GENERAL ELECTRIC A-C WELDERS used exclusively, helped speed up the construction of this huge vacuum tank, one of the largest of its kind ever built. Its fabrication required more than a mile of 3/8-inch groove and fillet welds, made with W-26 and W-24 electrodes. Applications such as this all over the country indicate the rapidly growing trend to a-c welding to speed up production and decrease cost.

Welding Speeds 15%?

THAT'S WHAT MANY MANUFACTURERS HAVE DONE BY CHANGING TO A-C WELDERS*

WITH a-c welding, arc-blow is seldom troublesome, therefore larger electrodes and higher currents can be used wherever the work permits. As a result, welding speed can often be increased 15 to 30 per cent.

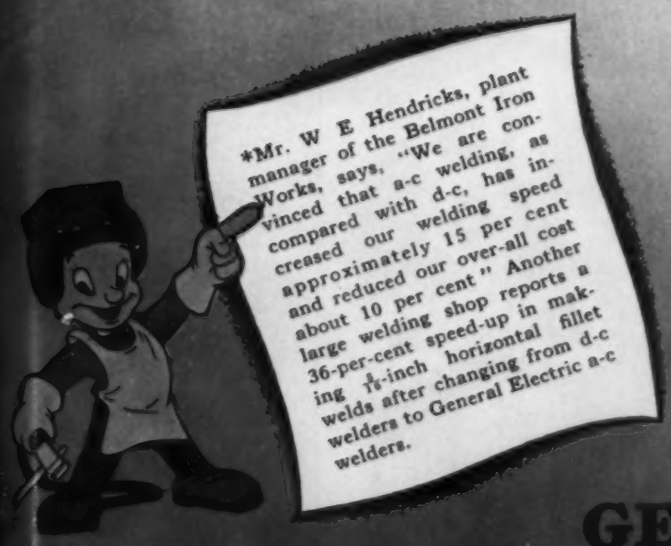
In addition, a-c welding gives these four extra advantages:

1. ASSURES HIGH-QUALITY WELDS—The molten pool is easily controlled, and the weld is uniformly strong because the operator is not troubled by arc-blow. This advantage is particularly apparent when welding in such locations as corners, where magnetic disturbance is usually most troublesome.

2. REDUCES ELECTRODE LOSS—Electrodes of the larger diameters, which can often be used with a-c welders, can be obtained 18 inches long instead of 14 inches. These longer electrodes reduce stub-end losses as much as 20 per cent.

3. CONSERVES POWER AND CRITICAL MATERIALS Power consumption is reduced as much as 50 per cent, compared with the power used by d-c welders of the same rating. This is because of the high efficiency of General Electric welding transformers. In addition, only half as much copper and electrical sheet steel is used in their construction.

4. REDUCES MAINTENANCE—General Electric a-c welders have no heavy rotating parts; therefore they require very little attention, other than oiling the fan and the adjusting screw.


*Mr. W E Hendricks, plant manager of the Belmont Iron Works, says, "We are convinced that a-c welding, as compared with d-c, has increased our welding speed approximately 15 per cent and reduced our over-all cost about 10 per cent." Another large welding shop reports a 36-per-cent speed-up in making ¼-inch horizontal fillet welds after changing from d-c welders to General Electric a-c welders.

FOR FIRST-CLASS A-C WELDING *In All Positions*

Use the W-26 Electrode

With this G-E alternating-current electrode you can now do *all-position* a-c welding to meet the following specifications:

A.W.S. Filler Metal Specification E6011

Navy Bureau of Ships, Specification 46E3, Grade III, Class I

A.S.M.E. Boiler Code, Paragraph U68

The W-26 electrode provides a strong, forceful arc and enables operators to make finished welds equal to those made with the best d-c electrodes used for mild-steel work

FOR COMPLETE INFORMATION about General Electric a-c welders, or the W-26 electrode—or for engineering help in increasing the speed and efficiency of your arc-welding operations—simply contact your local G-E arc-welding distributor or G-E office, or write direct to General Electric Company, Schenectady, N. Y.

The Army-Navy "E" for Excellence in the manufacture of war equipment, now flies over six G-E plants employing 100,000 men and women

GENERAL ELECTRIC

670-67-0140

Copyrighted, 1942, by General Electric Co

Cut Gears for Over 50 Years...
FIGHTING GEARS Today!

SIMONDS GEARS are meshed in the all-out drive for Victory—in our Battle of Ships, on the high seas and in the shipyards—in the mechanized products of Ordnance—in the Service of Supply—wherever cut gears of Simonds quality can do a vital job!

It is our pride to believe that the maturing skill of half-a-century—the painstaking craftsmanship bred of specialized gear-making for fifty years—have fitted us to uphold *the highest standards of quality,* while reaching production peaks thought impossible before December 7th, 1942.

THE SIMONDS GEAR AND MANUFACTURING CO.

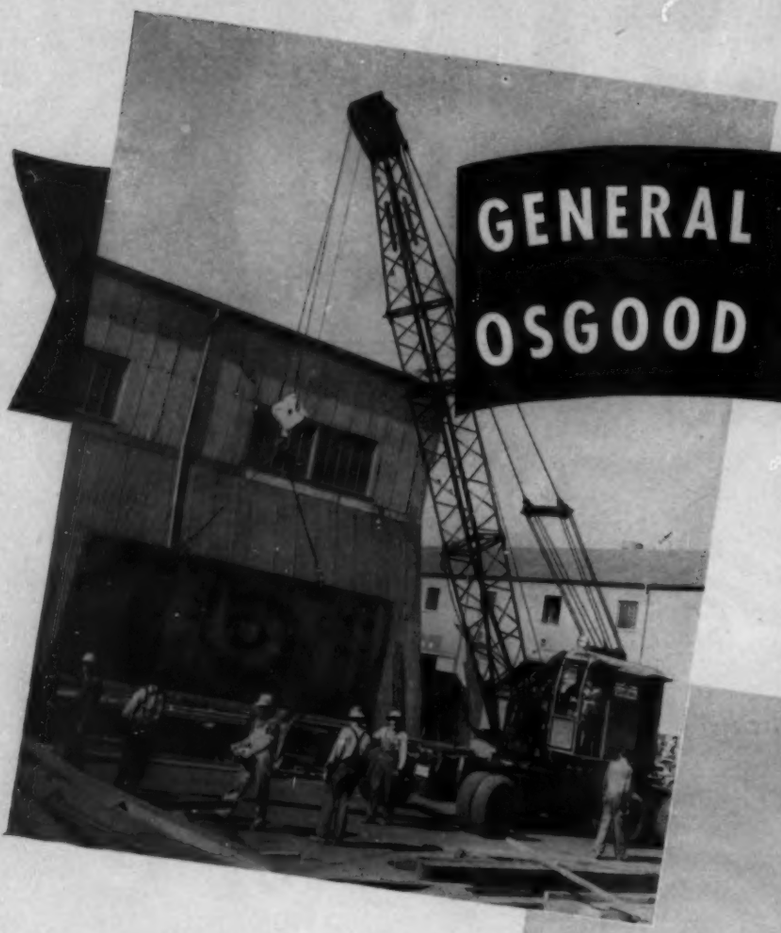
Liberty at 25th Street — MEMBER OF AGMA — **PITTSBURGH, PA.**

TOP QUALITY TOOL STEELS
FOR THE UNITED NATIONS

TOPS IN TOOL STEELS

Vanadium-Alloys

STEEL CO. LATROBE, PA.

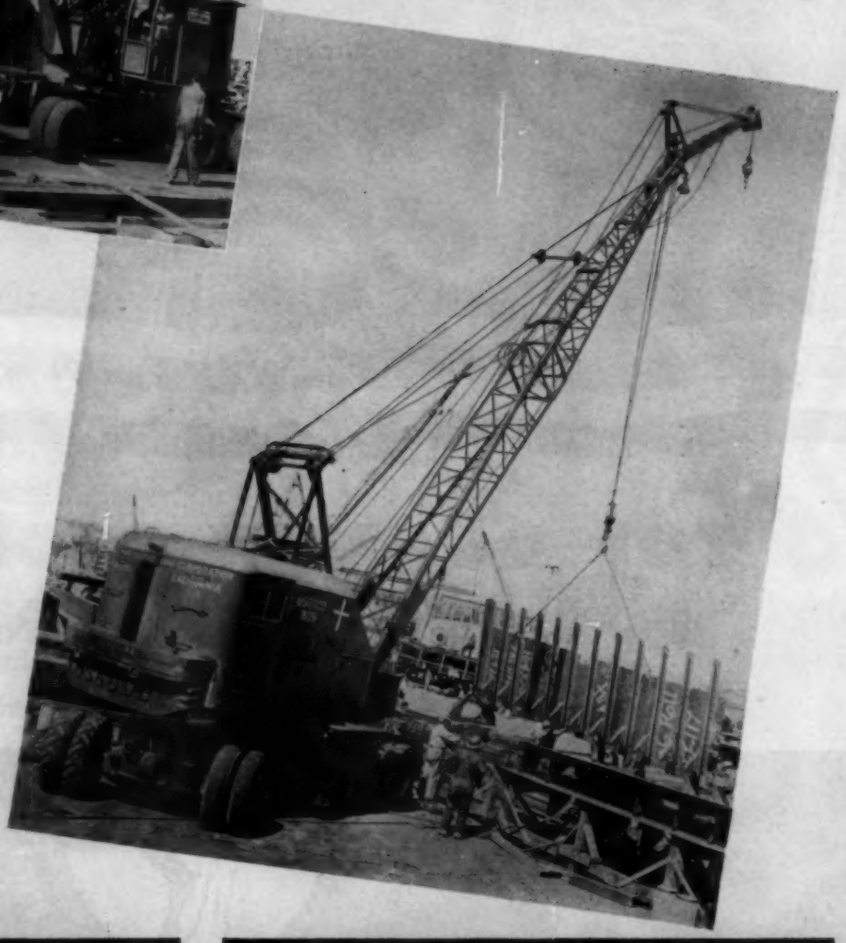


GENERAL SUPERCRANES AND OSGOOD MOBILCRANES

Rubber-Tired Cranes

One-Man Controlled

One-Engine Operated



Whenever materials need to be moved, these fast, highly mobile cranes will conserve vital time, fuel and material.

Pneumatic tires will not damage floors, docks, or runways—require no tracks or rails. Investigate now how they will help you win the Peace, after the War.

THE OSGOOD CO.
MARION, OHIO
MOBILCRANES

THE GENERAL EXCAVATOR CO.
MARION, OHIO
SUPERCRANES

STEEL AND SERVICE

LACLEDE'S CONTRIBUTION FOR VICTORY

- OPEN HEARTH STEEL INGOTS
- SLABS BLOOMS BILLETS
- WIRE RODS
- COLD DRAWN WIRE
  BRIGHT BASIC—SPRING WIRE—ALL FINISHES
- REINFORCING BARS
  STRAIGHT OR FABRICATED
- MERCHANT BARS—SHAPES
- HOT ROLLED STRIP—BANDS
- OPEN WEB STEEL JOISTS
- PIPE AND TUBES
  BLACK OR GALVANIZED
- WELDED WIRE MESH
- WELDED HIGHWAY PRODUCTS
- WELDED BUILDING PRODUCTS

STEEL WORKS WIRE AND TUBE MILLS
ALTON, ILLINOIS

BAR MILLS—WELDING & BAR FABRICATING
MADISON, ILLINOIS

WAREHOUSE AND FABRICATING PLANT
SOUTHERN STATES STEEL CORPORATION
SUBSIDIARY
DALLAS, TEXAS

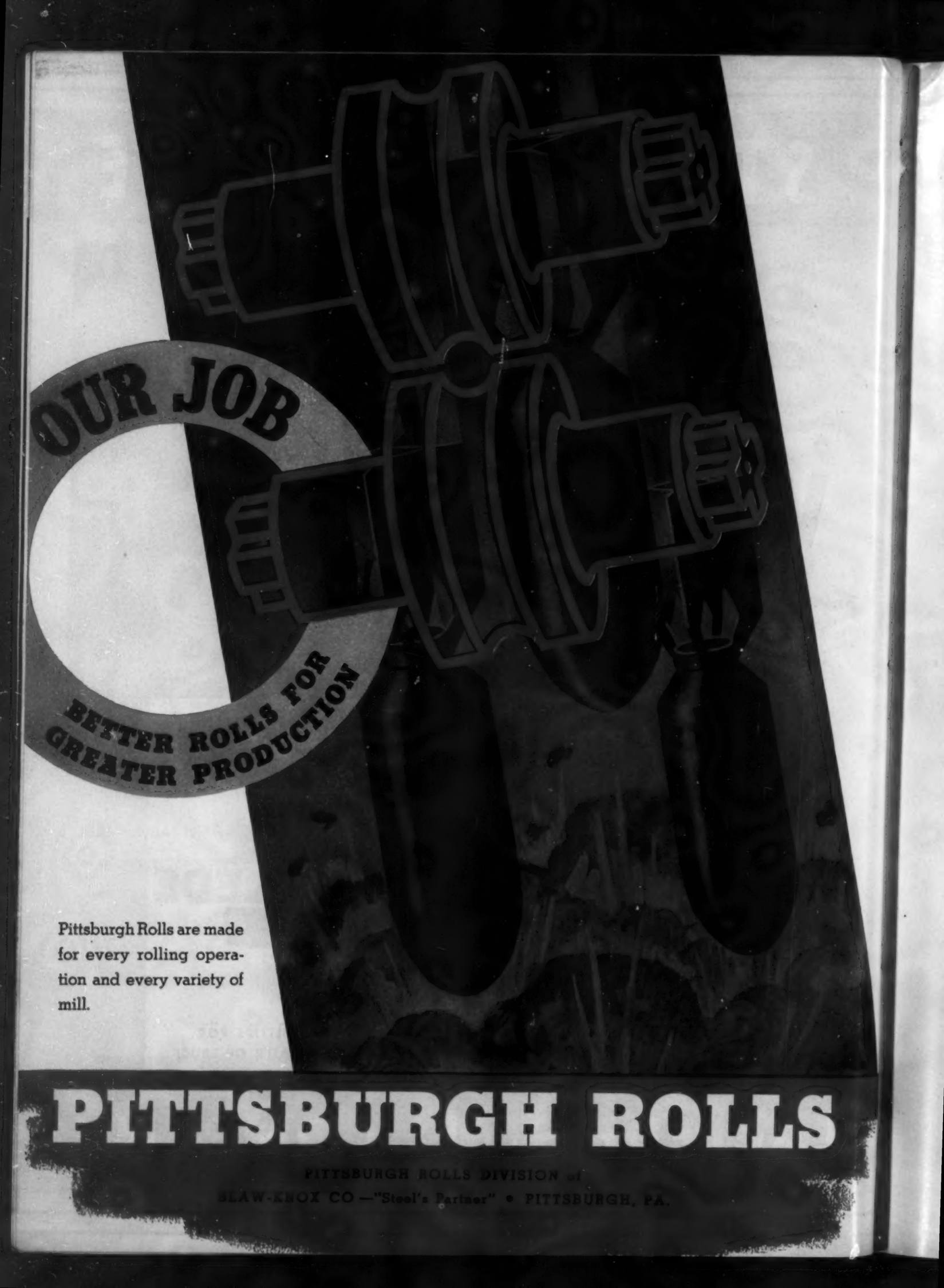
ASSURED QUALITY
IN STEEL

LACLEDE

FACILITIES FOR
RAIL WATER OR TRUCK
SHIPMENTS

LACLEDE STEEL COMPANY

SAINT LOUIS, MISSOURI



Pittsburgh Rolls are made for every rolling operation and every variety of mill.

PITTSBURGH ROLLS

PITTSBURGH ROLLS DIVISION of
BLAW-KNOX CO —"Steel's Partner" • PITTSBURGH, PA.

GRINDS INTERNAL AND EXTERNAL TAPERS TO ANY DEGREE
INTERNAL GRINDING A RING DIE JOB
ROUGH TURNING
SURFACE GRINDING WITH MAGNETIC CHUCK
FACE GRINDING
INTERNAL GRINDING WITH THE AUTO-SIZER

GRINDS AND TURNS...

... you can change-over this machine from rough turning to finish grinding *in a few seconds.* This versatile machine permits finishing several surfaces with but a single mounting, saving set-up time and assuring all surfaces being concentric to one another. Rough turns and finish grinds straight, taper, face or internal jobs up to 30" in diameter, and at production speeds. 7" cross-slide travel and 16" carriage travel handle external jobs up to 27" diameter. Hand-scraped, dove-tailed ways; adjustable tapered gibs; quick-change work speeds; variable quill speeds.

THE LEMPCO *Auto-Sizer*

Fool-proofs production runs, *duplicating sizes exactly on successive pieces.* Grind the first piece to size. Then simply set the "Auto-Sizer" for duplications. When wheel needs redressing, just reset the indicator to zero—which compensates for the abrasive removed—*and keep on grinding without a stop!* Inexperienced women are producing accurate work with the help of the Lempco Auto-Sizer.

★ *Good Delivery! Priorities Can Be Had — Write Us.*

SEE ONE WORK — MAIL THIS COUPON

LEMPCO

PRODUCTS · INC.
BEDFORD · OHIO · U·S·A
ESTABLISHED 1919

LEMPCO PRODUCTS, INC., Dept. SS, Bedford, Ohio
GENTLEMEN: Tell me the plant or shop nearest my place of business where I may see a Lempco Grinder.

NAME.....

ADDRESS.....

CITY..... STATE.....

Yoder ROLL FORMING

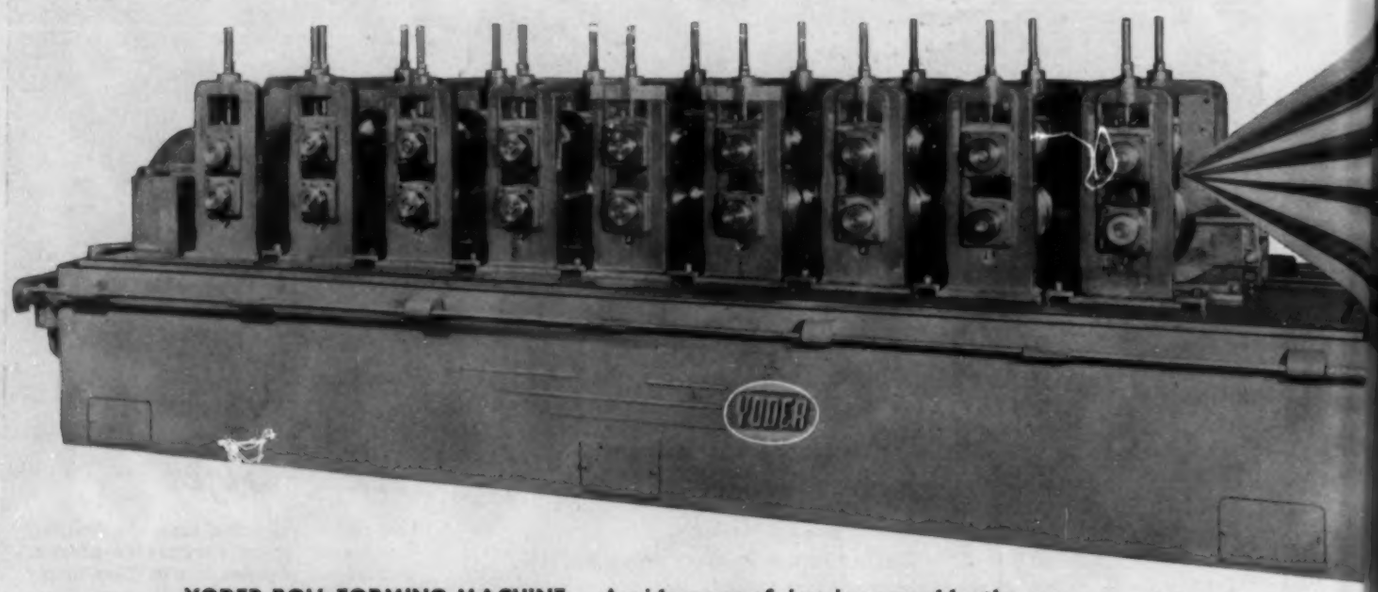
Win the War! This thought must be behind our every move. But, everybody knows that there is a day coming when we'll have to WIN THE PEACE!

Include in today's decisions some thinking for tomorrow. In the selection of a machine tool to do today's war production, naturally, you choose the one that will turn out the most and the best. However, doubly fortunate is the owner of a machine, the product of advanced engineering, that will be "in style" when needed again to produce those things so necessary to a high standard of civilian life.

When "the pendulum swings", you will be glad that you called on The Yoder Company for that Roll-forming Production Machine.

*YESTERDAY	*TODAY	TOMORROW
Stokers	Gun mounts	?
Electric fans	Flares	
Stoves	Metallic belt links	
Vacuum cleaners	Gas mask parts	
Road scrapers	Ammunition carts	
Steel vaults	Shell 105 m/m	
Radios	Bomb fuses	
Printing presses	Guns	
Valves	Hand grenades	
Office furniture	Bomb containers	
Electric refrigerators	Airplane parts	
Bottle coolers	Anti-tank mine	
Auto steering gears	Machine guns	
Auto accessories	Shell 37 m/m	
Adding machines	Automatic pistols	

**Actual War Time Conversions.*



YODER ROLL-FORMING MACHINE... A wide range of sizes is covered by the complete line of Yoder Roll-forming Machines. Also, each machine is designed to produce the greatest range with due regard to efficient operation. A large variety of metals and alloys can be roll-formed into a multiplicity of shapes. As pioneer designers and manufacturers of roll-forming machines, the Yoder Company has patented some fundamental features of great value. Tell us your problem.

ROTARY GANG SLITTERS AND SIDE TRIMMERS... Complete slitting and cut-up lines with all auxiliary equipment. For steel warehouses, steel and non-ferrous mills, job shops and fabricators. Built with shaft diameters from 2" to 12", in types suitable for sheet, coil strip, combination sheet and coil strip, for materials from 12" to 120" in width and gauges from shim stock to heavy sheet or strip. Completely engineered and manufactured in The Yoder Company plant.

RECOILERS, UNCOILERS AND COIL BOXES... This equipment can be designed and built in many different types, from the ball-bearing coil box to the cone type uncoiler with drag generator and from a simple stock reel to the large tension reels for steel mill use. A comparatively small part of "the line" but of paramount importance in the making of a quality product.

CUT-OFF EQUIPMENT... Full advantage of other machines in line can be had by the use of Yoder Flying Cut-off Equipment. The material can be cut to length and its forward speed synchronized with that of the entire line-up of machines. Tubing, moulding, wire rods, and strip metal can be cut with an accuracy of 1/64" plus or minus, and with proper tooling equipment, is able to attain speeds up to 150 feet per minute. The speed and accuracy of this machine has considerably increased the tempo of the metal forming process.

YODER TUBE MILLS... A coil of strip steel is edge conditioned—formed into a butt seam tube (in sizes from ¼" diameter, .015" wall to 26" diameter, ¾" wall)—electrically welded (a special Yoder feature)—flash trimmed—cooled—sized—straightened and cut to length—continuously—automatically—by a Yoder Tube Mill Line.

SPECIAL METAL FORMING MACHINERY... The Yoder Company has long been considered one of the most important designers and manufacturers of special production machinery. Perhaps the Yoder Engineers can help you. Send parts, blue prints, rough sketches and word descriptions of your ideas and problems for them to develop.

YOU GET THE IMPROVEMENTS FIRST FROM YODER

PRODUCTION MACHINES

IN A HURRY?

Our standard machines can at times be delivered more quickly than you might think.

THE YODER COMPANY

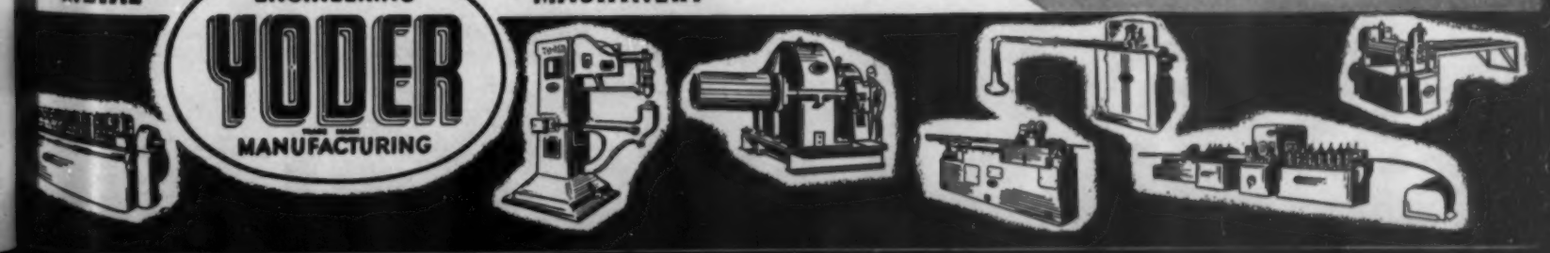
CLEVELAND, OHIO, U. S. A.

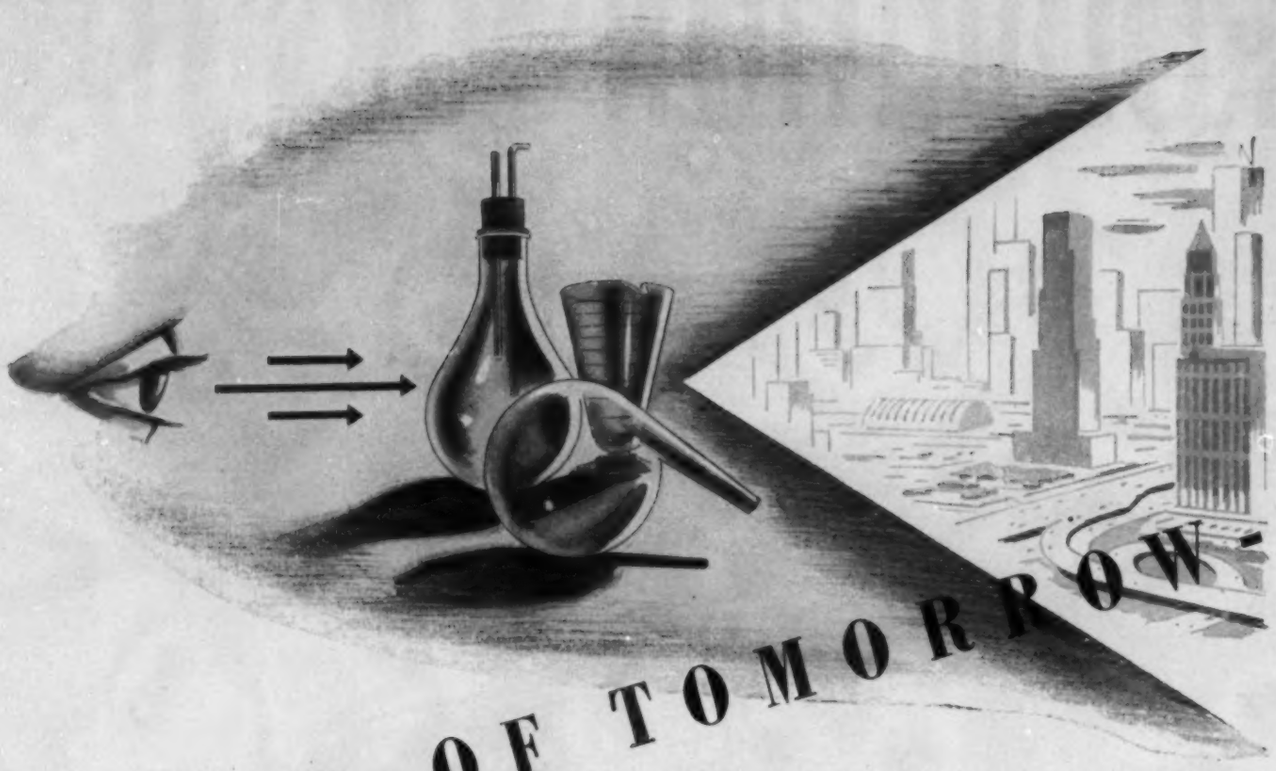
METAL • FORMING • PRODUCTION • MACHINERY

ENGINEERING

YODER

MANUFACTURING





TOMORROW'S America seems destined to be a veritable miracle land. The potentialities for the advancement of science and industry tending toward human betterment are literally astounding.

Hundreds of discoveries, processes and formulae are already being tried and perfected in both experimental laboratories and pilot plants. Some day this research work will result in the production of such amazing substances and new materials as to create a far higher standard of living.

In any number of these processes and developments there will be found an ever increasing need for special high temperature refractory products such as are originated, engineered and manufactured by The Carborundum Company.

For instance, there are at present over sixty-five standard and modified varieties of super refractories already being produced by Carborundum, each designed to meet a specific condition.

Here indeed is indicated a wealth of experience in the development of refractories, a wide background of practical and technical skill that is placed at the service of science and industry.

At this time, the refractory products of The Carborundum Company are wholly utilized by war work industries. This situation, however, does not prevent planning for the future.

So it is with the future in mind that we offer a complete consulting engineering service to cooperate with you in the application of the proper super refractories wherever necessary in your processing methods. Whether the condition calls for high refractoriness, high heat conductivity, resistance to spalling and softening or greater strength under elevated temperatures there is a Carborundum Brand Refractory to meet the service requirements.

If it is an entirely new application or the need for a refractory product not yet created, we would welcome the opportunity of tackling the problem with you.

CARBORUNDUM

THE CARBORUNDUM COMPANY • **PERTH AMBOY, N. J.**

REG. U. S. PAT. OFF.

Refractory Division

District Sales Branches: Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh. Distributors: McConnell Sales and Engineering Corporation, Birmingham, Ala.; Christy Firebrick Company, St. Louis, Mo.; Harrison & Company, Salt Lake City, Utah; Pacific Abrasive Supply Company, Los Angeles, San Francisco, Calif.; Denver Fire Clay Company, El Paso, Texas; Smith-Sharpe Company, Minneapolis, Minn.

(Carborundum is a registered trade-mark of and indicates manufacture by The Carborundum Company)

New Significance *for an* Old Name

HOWARD has long been a dominant name in the nonferrous castings field. Howard castings have been widely used in many well known machines and equipments.

Today, the name Howard takes on a new significance. Three plants combined — an aluminum foundry, a bronze foundry and a magnesium foundry — provide the largest nonferrous jobbing facilities in the United States. Our new magnesium foundry has a capacity alone of over 500,000 pounds of castings per month.

Naturally, America's war industries have turned to this dependable source of nonferrous castings; and all three plants are supplying the needs of makers of planes, guns, tanks, ships, military vehicles and essential machines.

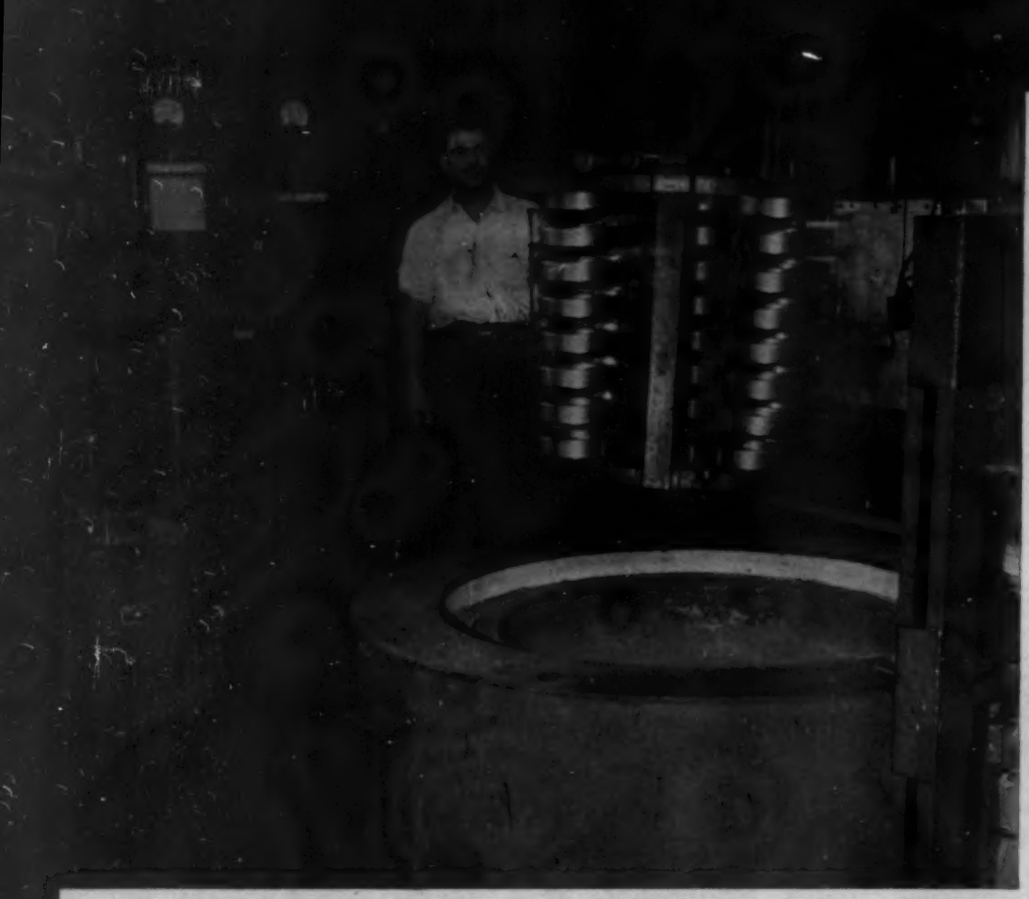
Today, Howard castings are available only to those with adequate priority ratings, but war uses of nonferrous castings are pointing the way to new and important peace-time applications, especially in the field of magnesium. Accordingly, Howard will be in a position to render a broader service to industry after the war.

Howard Foundry Company
4900 Bloomingdale Road Chicago

HOWARD

ALUMINUM · BRASS · BRONZE · MAGNESIUM

CASTINGS



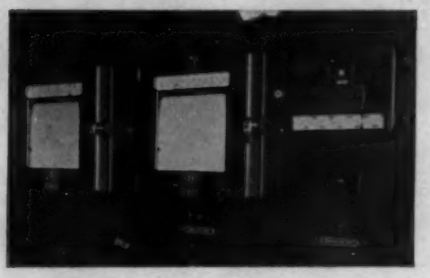
Heat-treater lowers a charge of bearing races into furnace, for hardening by the Vapocarb-Hump Method. There will be three advantages: little or no refinishing; practically no rejections; and long life for the races. These result from Vapocarb protective atmosphere; rate-of-heating control; Hump Method detection and recording of the critical for each individual furnace charge; fully automatic Micromax control of the furnace.

V depends on me!

metals, its value increases as the percentage of alloy shrinks. Vapocarb helps a little alloy go the limit in service.

Warp? The Vapocarb-Hump Method's Micromax Pyrometer applies a very special Rate of Heating Control which can be used to end all unexpected warp. It does this by letting the heat-treater find out, from the work itself, just what the fastest safe heating rate may be; the man then sets the Control, and the work is automatically handled in accord. Warp is beaten before it starts.

If you have a heat-treatment problem for ferrous alloys of any type, let us know. We'll gladly try to help solve it.



If you've used a Micromax Pyrometer, you know it holds any furnace to its best performance. An advantage of Vapocarb-Hump hardening and Homo tempering is that these Methods are designed to take full advantage of the Micromax abilities . . . its micro-responsiveness, its accuracy, its fully-automatic nature. Photo shows control panel for a Vapocarb-Hump and Homo equipment.

REMEMBER THE "HUMP"?

It's Fine For the New Low Alloys!

Shown here are scenes of furnace operation in a heat-treat which is well-equipped to handle the new, so-called "low-alloy" parts.

This heat-treat was originally set up to harden and temper the races for high-alloy anti-friction bearings. Like many another shop, this one selected the Vapocarb-Hump hardening and Homo-Tempering Methods. Now races will be made of low alloys, instead of high . . . but see how well they, also, can be handled:

First, the "Hump Method" applies with redoubled value. For, with alloy content going down and carbon going up, the relation between critical and quench becomes increasingly important . . . and the Hump Method points an unerring finger to the critical—regardless of heating rate, actual temperature, or any other factor. Obviously, the Hump is what the heat-treater needs for the low alloys.

Then there's the Vapocarb atmosphere. Designed to protect the surfaces when there were plenty of alloying

Homo Method Tempering gives "perfect" uniformity because forced convection carries clean, electrically-heated air to every exposed surface of each part in the furnace charge. Under automatic Micromax control the work comes swiftly up to temperature; soaks with no overshooting or falling away; leaves the furnace ready to pass any Army or Navy inspection for uniformity.

Jrl Ad T-621(28)

LEEDS & NORTHRUP COMPANY, 4957 STENTON AVE., PHILA., PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

AIR SQUEEZE ACTION AUTOMATIC FEED RIVETING

Air Powered RIVITOR

For aircraft production, Model RP shown, also available in "Twin" types for setting two rivets at the same time.

To make this Rivitor do the best possible job of setting aluminum alloy rivets it was designed for aluminum alloy rivets exclusively. We included two important features — air squeeze action and automatic feed.

Pressure of a 6" air cylinder is applied through a toggle mechanism to attain the required amount of air squeeze action so essential for efficient riveting of aircraft parts.

The model RP Rivitor is of steel plate construction, has precision adjustable tool setting, capacity of 1/4" dia. x 3/4" long aluminum alloy rivets, and will also do flush riveting on a production basis. Get our bulletin RP-1.

THE TOMKINS-JOHNSON CO.

T-J

611 N. MECHANIC ST. JACKSON, MICHIGAN

MALLORY STANDARDIZED WELDING ELECTRODES

SPEEDIER PRODUCTION

BETTER WELDING

LESS DOWN TIME

LOWER COST

Flash Welding Speeds Production of Steel Strip!

Strip steel . . . needed for aircraft assemblies, destroyer smokestacks, "jeep" bodies, Army field kitchens and bomb fins . . . for literally thousands of military and industrial purposes . . . is speeded to war production plants by welding with Mallory Flash Welding Dies.

In one of the world's largest strip mills, the resistance flash welder shown above joins single coils of strip steel to form multiple coils. Major advantages are:

1. *Speedier Production.* It is much faster to "thread" multiple coils through picklers, rolling mill stands and shears than to thread shorter, single lengths of strip.

2. *Greater Uniformity.* The percentage of "off-gauge" and scrap steel is minimized.

3. *Meeting Customers' Requirements.* Many users prefer longer, heavier coils.

Flash welding is the best commercial process for joining strip in steel mills, because the welds are made automatically. Operators are quickly trained. Machine maintenance can be kept to a minimum . . . especially since most flash welders are equipped with dies produced by Mallory, and these dies assure more welds between dressings, a higher total number of welds before replacement is necessary, and thus sounder, more uniform welding.

Mallory Standardized Welding Electrodes—spot welding tips, seam welding wheels and flash welding dies—are used in major steel and copper mills, in aluminum and magnesium plants . . . in factories turning out war planes and parts for aircraft, ships, shells, guns and tanks. Mallory's long research has led to superior electrode materials, designs and cooling methods . . . Today Mallory is developing new electrode designs, new non-ferrous alloys and powdered metal products to help weld the way to Victory!

A BOOK YOU WANT for your technical library is the latest *Mallory Resistance Welding Data Book.* Facts on spot, seam and flash welding ferrous and non-ferrous metals and alloys. Write for your copy today!

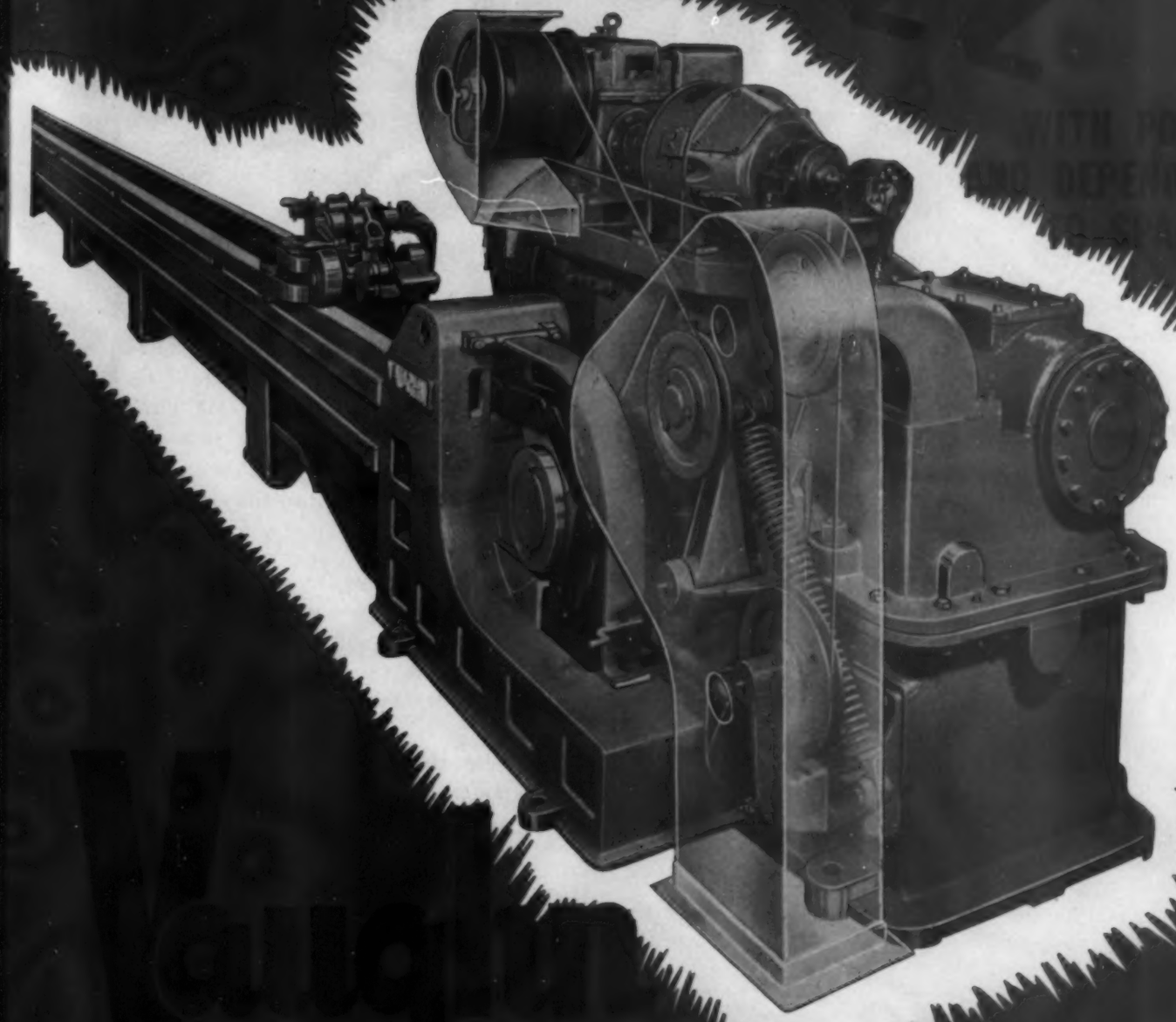
P. R. MALLORY & CO., Inc., INDIANAPOLIS, INDIANA • Cable Address—PELMALLO

ARMY E NAVY

RESISTANCE WELDING P. R. MALLORY & CO. Inc. MALLORY **STANDARDIZED ELECTRODES**

BUILT FOR THE

Long Pull



Vulcan

DRAW BENCHES

....then there are *builders* of the more enduring

Dreamy hours upon a hilltop . . . . fleecy clouds envelop silvery projects that only a shifting breeze can erase. These are the mental perceptions of youth that feed the will to go ahead. But to most of us, nothing will ever quite match, in reality, the reveries of our adolescence . . . the winds seem just a bit too strong.

We've all faced equivalent circumstances in our world of manufacturing. Through pressure brought to bear via insufficient time or misjudgments, we have accepted poorly built or inadequate components that in turn have weakened the entire structure of our product—faltering to the *trade-winds* of competition.

The proper selection of a spring product might appear insignificant compared with a motor, a gear or a lubricant—yet a spring, when dynamically loaded, is an engine and energy is stored in it under deflection to be released at a given moment in the form of power . . . . Hence a scientifically designed and technically produced spring becomes a product *more enduring*—a product we have rightfully named: Lee-Built SCIENTECH Springs.

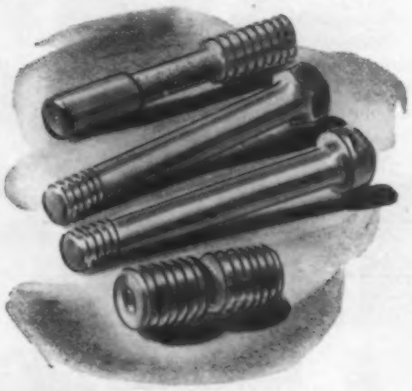
SCIENTECH
Spring Service

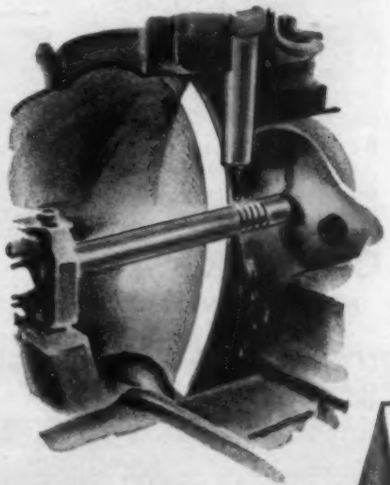
LEE SPRING COMPANY, INC.
30 MAIN STREET BROOKLYN, N. Y.

He flies a plane held together with threads!

At 400 m.p.h. a fighter pilot's life literally hangs by a thread. For the bolts and studs which help hold his engine and plane together are only as strong as their threads. Fortunately those threads can be counted on to hold. A special grinding process makes them far safer and stronger today than they would have been a few years ago. In this process, Carborundum-made grinding wheels play an important role.

The method of grinding produces threads of almost unbelievable accuracy, free from microscopic checks and cracks which might cause failure under stress. This greater accuracy justifies a smaller safety factor, reducing weight of dead metal. And in most cases, production is speeded and costs reduced.





Thread grinding is typical of the many ways in which products and processes developed by Carborundum are serving America by helping industry do a better, faster job at lower cost. The Carborundum Company, Niagara Falls, New York.

CARBORUNDUM
Reg. U.S. Pat. Off.
ABRASIVE PRODUCTS

Carborundum is a registered trade-mark of and indicates manufacture by The Carborundum Company.

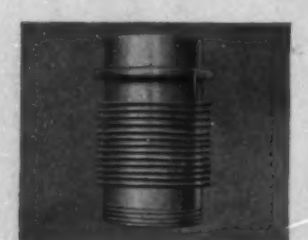
Pack TOUGHNESS into sinews of war with nitrided

NITRALLOY

WITH its power to pack toughness into the sinews of war, NITRIDED NITRALLOY has assumed gigantic stature as an aid to speedy victory by adding days, months—even years—of life to steel parts. NITRIDED NITRALLOY, producing the hardest steel surface known, will multiply the might of whatever calls for greatest possible resistance to wear, fatigue or abrasion.

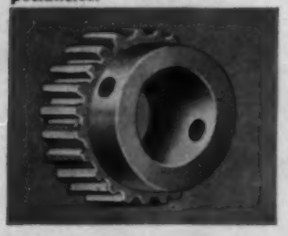
For extreme case hardness and controlled core properties—even at sustained high temperatures—specify NITRIDED NITRALLOY to help win the war faster.

Nitralloy Steels are available under Government regulations through any of the companies listed below. For detailed technical data, write to any of them or to us.



Life of aircraft engine cylinders, wrist pins and bearings is increased with Nitrided Nitralloy.

Nitrided Nitralloy gears endure greatly beyond former life expectancies.



Bushings stand up far longer when Nitrided—even at sustained high temperatures and without lubrication.

Scarcely a field remains where Nitrided Nitralloy has not lengthened the life of steel parts to an unprecedented degree.

THE NITRALLOY CORPORATION

230 PARK AVENUE • NEW YORK, N. Y.

Companies Licensed by The Nitralloy Corporation

ALLEGHENY LUDLUM STEEL CORP...WATERVLIET, N. Y.
BETHLEHEM STEEL CO.....BETHLEHEM, PA.
COPPERWELD STEEL CO.....WARREN, O.
CRUCIBLE STEEL CO. OF AMERICA..NEW YORK, N. Y.
FIRTH-STERLING STEEL CO.....McKEESPORT, PA.
REPUBLIC STEEL CORPORATION.....CLEVELAND, O.
THE TIMKEN ROLLER BEARING CO.....CANTON, O.
ROTARY ELECTRIC STEEL CO.....DETROIT, MICH.
VANADIUM-ALLOYS STEEL CO.....PITTSBURGH, PA.
ATLAS STEEL LIMITED.....WELLAND, ONTARIO

Operating and Accredited Nitrided Agents

CAMDEN FORGE CO.....CAMDEN, N. J.
COMMERCIAL STEEL TREATING CORP., DETROIT, MICH.
ENGELHARD & KENNEY....NORTH ARLINGTON, N. J.
THE LAKESIDE STEEL IMPROVEMENT CO., CLEVELAND, O.
LINDBERG STEEL TREATING CO.....CHICAGO, ILL.
LINK-BELT CO.....PHILADELPHIA, PA.
MET-LAB, INC.....PHILADELPHIA, PA.
NEW ENGLAND METALLURGICAL CORP., BOSTON, MASS.
PITTSBURGH COMMERCIAL HEAT TREATING CO.....PITTSBURGH, PA.
QUEEN CITY STEEL TREATING CO.....CINCINNATI, O.
REX & ERB.....LANSDALE, PA.
WESLEY STEEL TREATING CO.....MILWAUKEE, WIS.
N. A. WOODWORTH CO.....FERNDALE, MICH.
ONTARIO RESEARCH FOUNDATION.....TORONTO, ONTARIO, CANADA

Manufacturers of Nitralloy Steel Castings

LEBANON STEEL FOUNDRY.....LEBANON, PA.
EMPIRE STEEL CASTINGS CO.....READING, PA.
THE MASSILLON STEEL CASTING CO...MASSILLON, O.
MILWAUKEE STEEL FOUNDRY DIV., GREDE FOUNDRIES, INC.....MILWAUKEE, WIS.
WARMAN STEEL CASTING CO....LOS ANGELES, CAL.

X3358

FOR a good many years we have talked about how Jones speed reducers, gears and other transmission products have been built for long trouble-free service. Some people might have said that we placed too much emphasis on ruggedness, stamina and the ability of our products to "stand up and take it".

But today in every phase of war work, industry is calling for products that will measure up to these standards by continuously staying on the job.

Our Bulletin No. 80 "Jones Drives for Industry" will give you a complete outline of the range of Jones speed reducers, gears and other transmission products that are built to stand the 24-hour a day drive for victory. We shall be glad to mail you a copy.

W. A. JONES FOUNDRY & MACHINE CO., 4437 Roosevelt Road, Chicago, Illinois

Jones

between two worlds . . .

AMERICA today is in the greatest period of transition of any nation at any time in history. We are between two economies, two ways of life, two worlds.

They are vastly different, those two worlds. One we know all too well. That one is the pre-war world . . . and the other we're scarcely able to visualize. It is the post-war world of tomorrow.

But there is much about the post-war world that *can* be visualized in the light of what is happening today, and behind the scenes of industry there are men who already know something of the nature of that world.

The most important thing that many of them see there is prosperity!

They see vastly less monopoly control, as international cartels, patent bottlenecks, restrictions of raw materials, and price maintenance are succumbing to the common cause of winning this war.

They see thousands of plants, small in pre-war days, emerging with capacity and a war-created efficiency. They see new techniques, new skills, new materials, new products . . . new competition based upon more plentiful supply and a lower price structure.

And lastly, they see the greatest consumer market of all time, with billions in savings from war bonds and restricted buying, needing millions of automobiles, appliances, homes and heaven knows what.

If you are looking toward that kind of post-war world, the time to start your production planning is *now* . . . and in that there is one thing you can do:

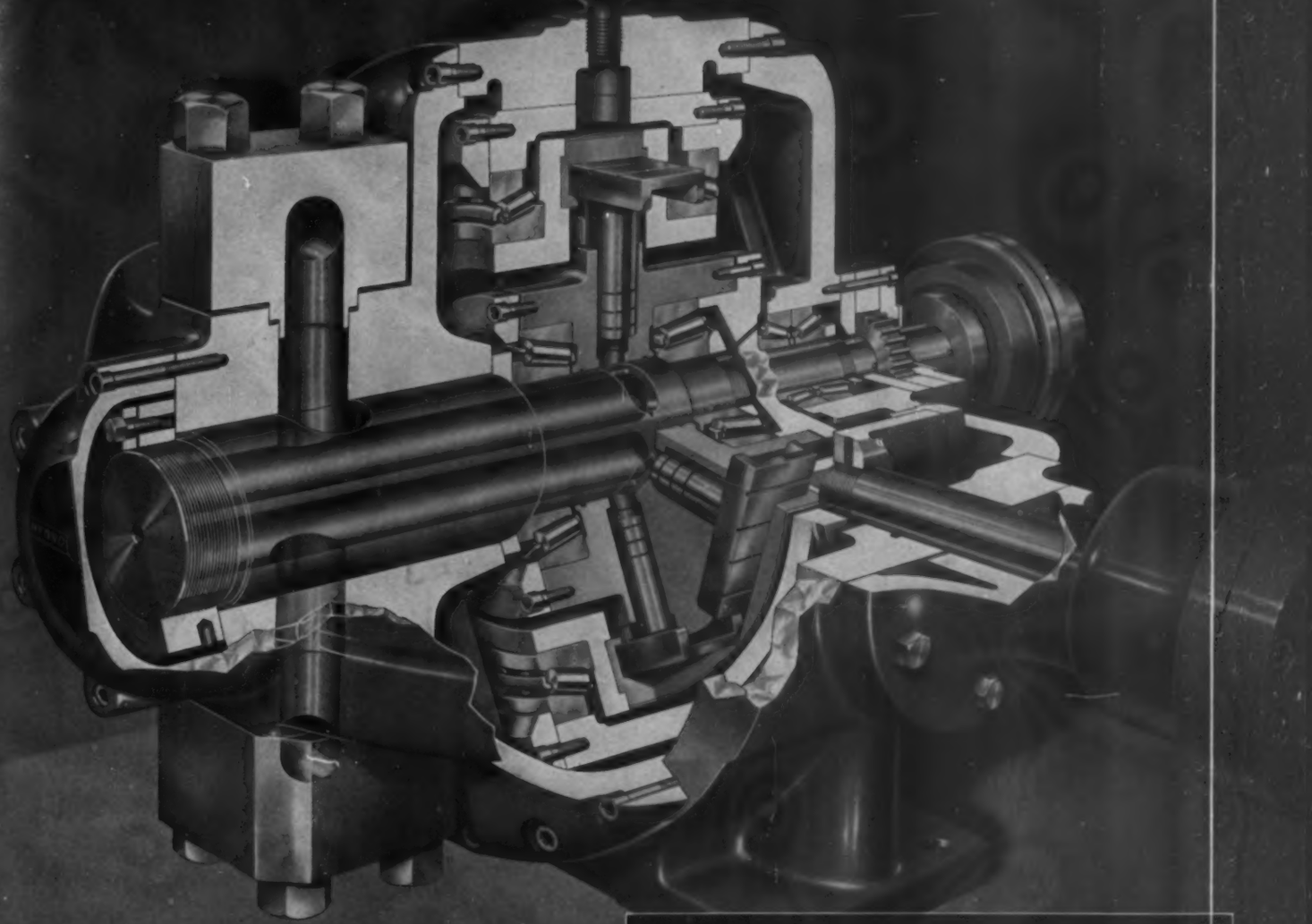
Write to Bryant! Send us your internal grinding problems, and take advantage of the work which our engineers can do *now* to help you formulate production plans and tool up for the great new world that lies ahead.

SEND FOR THE MAN FROM BRYANT

BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U.S.A.

A Dependable Source of Hydraulic Power



NO OTHER HYDRAULIC PRESSURE GENERATOR HAS THESE OUTSTANDING FEATURES:

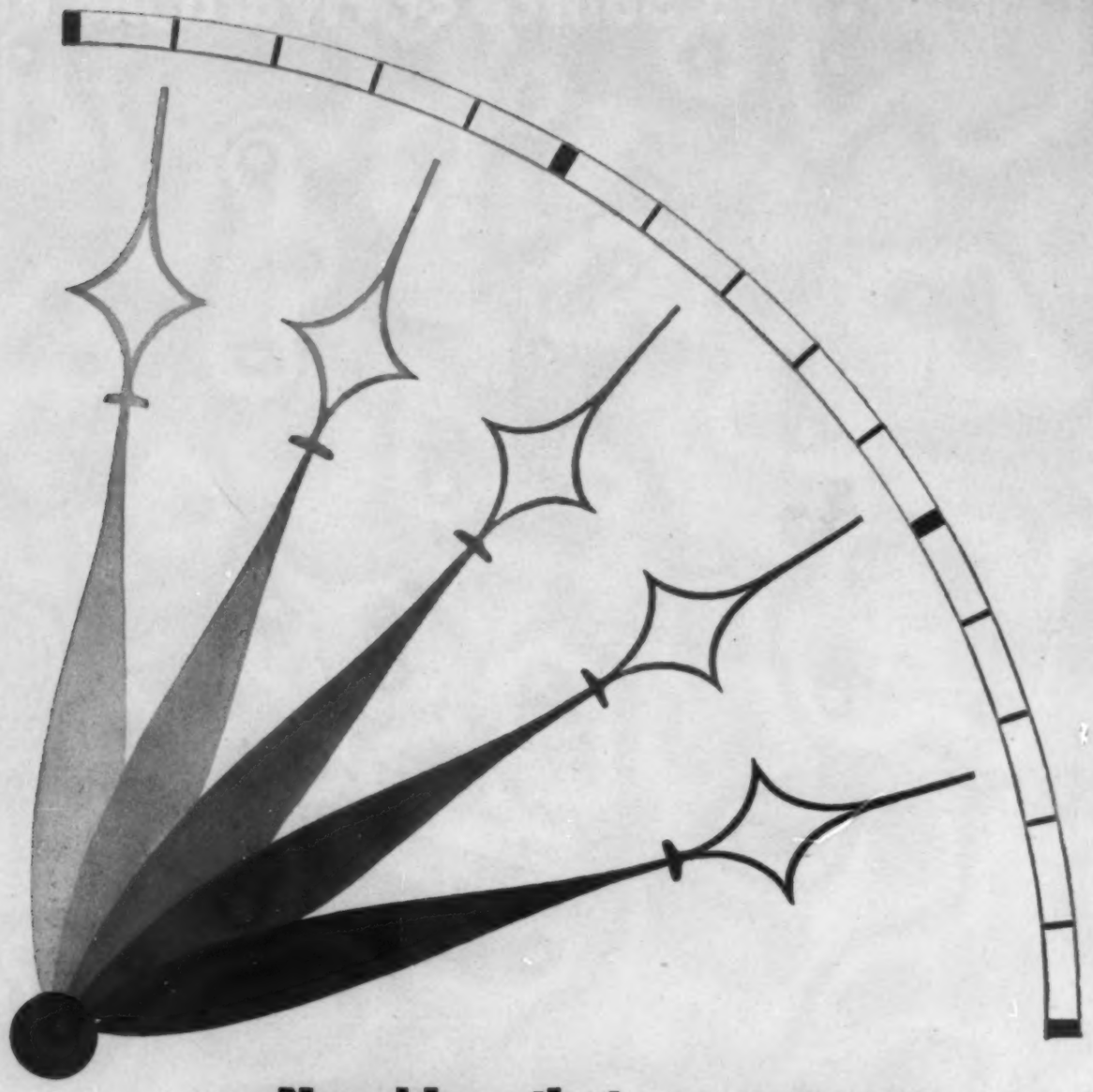
1.—Tapered roller bearings maintain a positive mechanical separation between cylinder rotor and central valve spindle.

2.—Take-up adjustment of tapered bearings is provided to maintain initial pre-loading for life. This is accomplished from outside of pump, without dismantling.

THE HYDRAULIC PRESS MFG. CO.
Mount Gilead, Ohio, U.S.A.

District Sales Offices: New York, Syracuse, Detroit and Chicago. Representatives in Principal Cities

HYDRO HPM POWER RADIAL PUMPS AND CONTROLS are the Basis for the Dependable, Efficient Operation of HPM FASTRAVERSE METAL WORKING PRESSES



New ideas that can save you

Precious Production Minutes

EVERY MINUTE SAVED TODAY is worth its weight in gold. That's why Shell men are being kept on the jump. They have ideas that can save those precious minutes.

These ideas have been proved and tested. They have solved the toughest kind of cutting oil problems. No, Shell men don't know *all* the answers. But their application of the Shell control technique has stepped up production, improved surface finish, increased tool life, shortened "down-time" in practically every metal-working industry. This technique "balances" the oil for each specific job . . . fits the oil to the machine, the application and the tool.

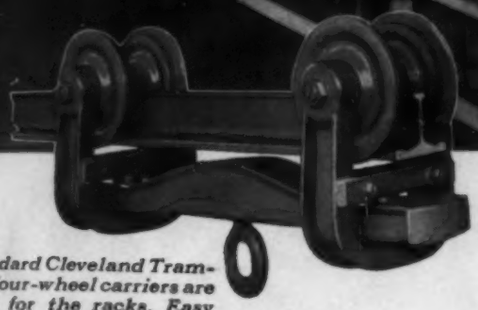
Call in the Shell man now. Have him show you how Shell's control technique can be used to advantage in your *plant.*

OIL IS *Ammunition* -USE IT WISELY

SHELL

SHELL LATA OILS *for Cutting*

Long trains of racks with loaded shells can be easily pushed by one man.



Standard Cleveland Tramrail four-wheel carriers are used for the racks. Easy rolling, they require only 5 lbs. starting effort and 0 lbs. running effort, per ton weight.

LOADING ARTILLERY SHELLS AT A LARGE GOVERNMENT ARSENAL

Serving this great modern arsenal is a Cleveland Tramrail system that includes approximately 9½ miles of arch beam track, 652 track switches and 2,872 carriers, plus smaller quantities of other equipment. This system conveys the shells from the cleaning room to the shell loading department, thence to the boostering building where the shells are completed, and finally to the shipping department.

NON-SPARKING was the first and foremost requisite for all equipment going into this plant. Every precaution was taken to select equipment that could readily be made spark-proof as the least little spark can set off tons of high explosives and cause terrific damage to life and property. Cleveland Tramrail was found to meet the requirements and to be easily adaptable for this work.

Carriers and racks were provided with heavy rubber bumpers. Switches were equipped with special alloy latch pins and fibre stop pads. The chilled iron wheels used for all Cleveland Tramrail carriers were found satisfactory since they do not cause sparking when in contact with the steel rails as will cast steel or forged steel wheels.

Similar equipment has been installed in or is on order for several other large shell loading plants in various parts of the country.

BOOKLET No. 2008 . . Packed with valuable information. Profusely illustrated. Write for free copy on your company letterhead.

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THE CLEVELAND CRANE & ENGINEERING CO.
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OVERHEAD MATERIALS HANDLING EQUIPMENT

WHAT ABOUT
TOMORROW'S GRINDING COSTS?

You can cut tomorrow's costs with the Fitchburg Grinders you buy today.

Fitchburg low cost method of mounting standard Bowgage Head Grinding Wheel Units for special single applications, or to multiple grind special jobs, will give you faster wartime production at lower cost, and leave you in a position to make rapid changeovers when the present emergency is over.

All Fitchburg Bowgage Head Automatic Precision Grinding Wheel Units are standard. They can be remounted on standard machines, or on new special bases, for operations other than the one originally specified. This feature protects your investment.

Save time and money — speed up cylindrical production grinding with Fitchburg Bowgage Heads.

This Book shows how to cut grinding costs. . . . Free to executives. . . . Write for it today.

FITCHBURG GRINDING MACHINE CORP.

FITCHBURG, MASSACHUSETTS, U.S.A.

Manufacturers of—Bowgage Wheelhead Units, Multiple Precision Grinding Units, Spline Grinders, Cylindrical Grinders, Gear Grinders, Bath Full Universal Grinders and Special Purpose Grinders.

Control...

THE CRITICAL FACTOR IN "PRODUCTION LINE" SHIPBUILDING OR STEEL CASTING

In the new "production line" shipyards, vessels slide down the ways at a speed which will make history tragic for the Axis. The swift pace of this new type of shipbuilding is made possible by close control over each step of production.

Control as the critical factor in production for modern war is a principle which has always been strongly emphasized at the Lebanon Steel Foundry. Lebanon neither overlooks nor slights any control step that will promote the soundness and integrity of Circle Ⓛ Castings.

One important Lebanon control operation is illustrated above. The expertly trained inspector is checking a casting for dimensional accuracy. All Circle Ⓛ Castings are given this check-up to see that they correspond to specified dimensions. Wall sections are measured for thickness. Cored areas are thoroughly studied and templates are used to check these areas against blueprints.

Castings of the soundness and integrity demanded at vital points by America's military and industrial forces cannot be produced by short cuts. To obtain Circle Ⓛ quality, Lebanon pays the premium of close control over every phase of production. That's why Circle Ⓛ Castings measure up to the requirements of industries that will not compromise with high standards . . . industries such as Worthington Pump and Carrier Corporation.

Lebanon metallurgists have had close contact with war production requirements since the beginning. Their experience in solving today's type of industrial problem is available to interested organizations.

LEBANON STEEL FOUNDRY • LEBANON, PENNA.

ORIGINAL AMERICAN LICENSEE GEORGE FISCHER (SWISS CHAMOTTE) METHOD

LEBANON *Stainless and Special Alloy* **STEEL CASTINGS**

CIRCLE L

IN TIMES LIKE THESE *a man needs all the help he can get!*

ARE YOU

DRAWING STEEL CARTRIDGE CASES?

Houghton is working cooperatively with contractors on this new type of case. We can help you in the selection of the best drawing compound to ease the draw.

HEAT TREATING ARMOR-PIERCING SHOT?

Neutral hardening in salt . . . decremental hardening . . . stress relieving—Houghton has products and processing data which will aid in your heat treatment.

DRILLING, REAMING and RIFLING GUN BARRELS?

Houghton is helping makers of small arms and medium caliber guns produce faster and more accurately, by supplying cutting fluids that take plenty of punishment and assure high finish, longer tool life, fewer rejects.

HARDENING HIGH EXPLOSIVE SHELLS?

Lower alloy steels require fast rate of quenching. Houghto-Quench, devised for armament work, answers the quenching problem . . . makes it possible to meet government standards while conserving vital alloys.

RUST-PROOFING BETWEEN OPERATIONS, IN STORAGE OR SHIPPING?

Name your problem; we have the answer, based on seventy years of rust prevention. Every required consistency and type of Houghton's Cosmoline and Rust Veto to meet government and industrial specifications.

CARBURIZING ARMOR PLATE?

Light, medium or heavy plate—we supply carburizing compounds used for most of the case-hardened armor plate now being produced for the war effort.

Do you receive "WAR PRODUCTION DATA from The HOUGHTON LINE?" It tells more about the above and related metal processing. It's free.

E. F. HOUGHTON & CO.

Oils, Leathers and Metal Working Products

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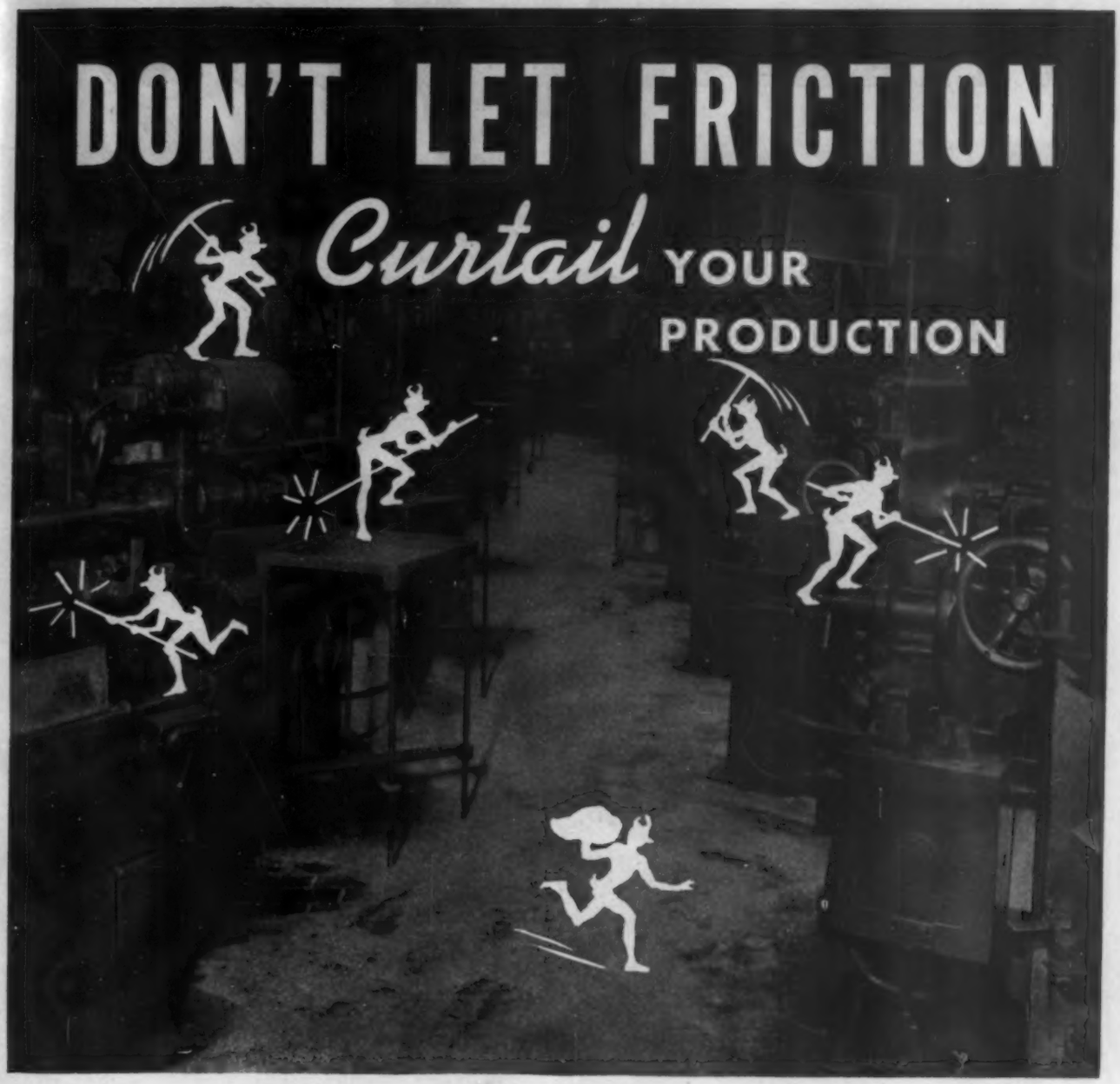
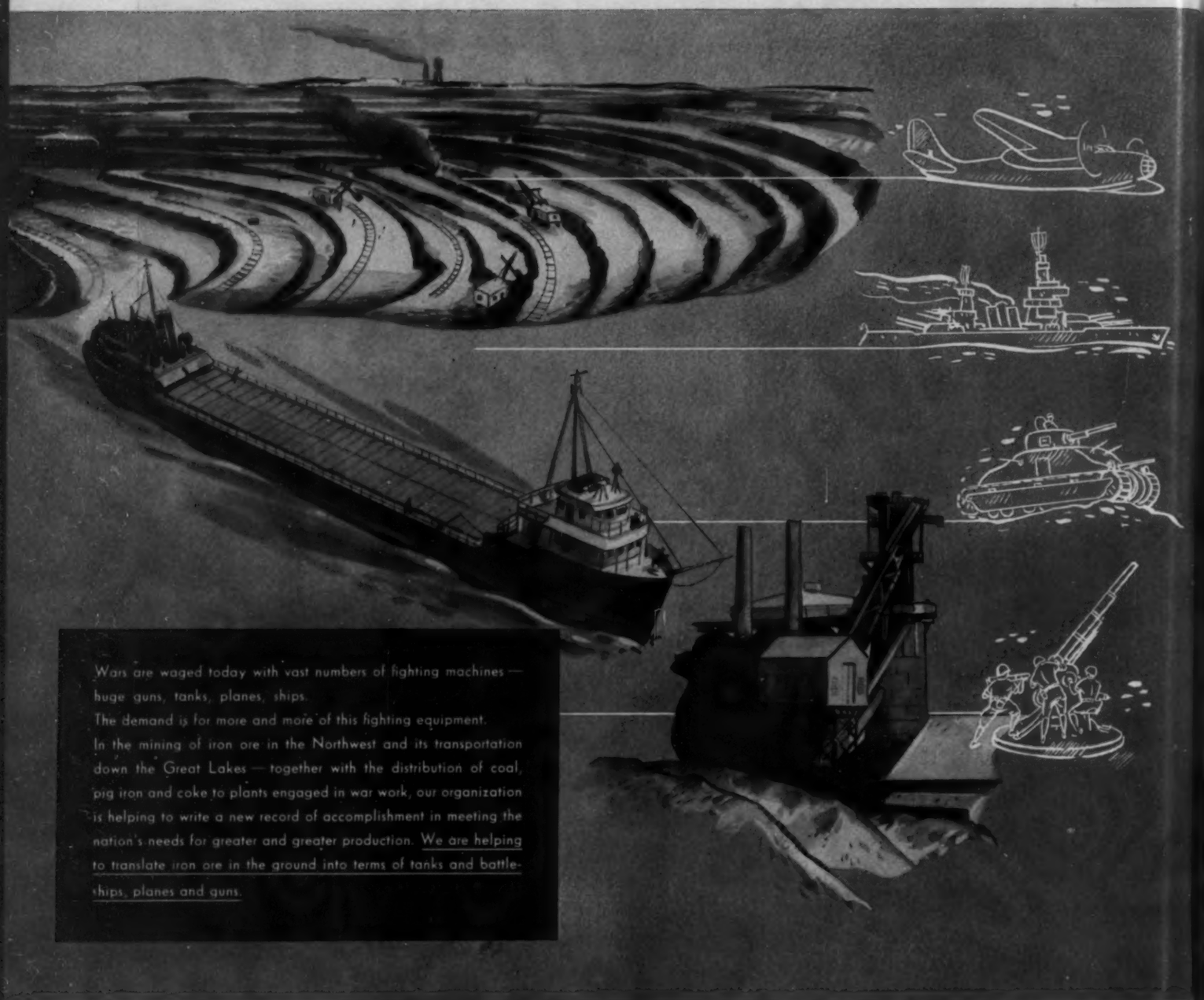


In the high-speed drive for Victory, FRICTION finds its greatest opportunity. Machine operators have rest intervals, but the machines themselves have none. And so, normal inspections and adjustments may be overlooked—lubrication may be neglected—a bearing becomes dry or dirty, and over-heated—FRICTION'S agents get in their deadly work—and A DAMAGED, BURNED-OUT OR RUINED BEARING CRIPPLES A VITAL TOOL.

Let NORMA-HOFFMANN engineers help you guard your bearings against FRICTION'S "saboteurs"—dust, dirt, grit, moisture, poor lubricants, inadequate lubrication. Give each bearing periodic inspections—watch for unusual noise or heat—keep your bearings clean—use the lubricant best adapted to the duty involved. If possible, have replacement bearings at hand. * * * Our engineers are at your service, with 30-odd years of specialized experience in bearing application, operation and maintenance.

NORMA-HOFFMANN BEARINGS CORP'N., STAMFORD, CONN. . . . FOUNDED 1911

VITAL TO Victory



Wars are waged today with vast numbers of fighting machines — huge guns, tanks, planes, ships.

The demand is for more and more of this fighting equipment.

In the mining of iron ore in the Northwest and its transportation down the Great Lakes — together with the distribution of coal, pig iron and coke to plants engaged in war work, our organization is helping to write a new record of accomplishment in meeting the nation's needs for greater and greater production. We are helping to translate iron ore in the ground into terms of tanks and battleships, planes and guns.

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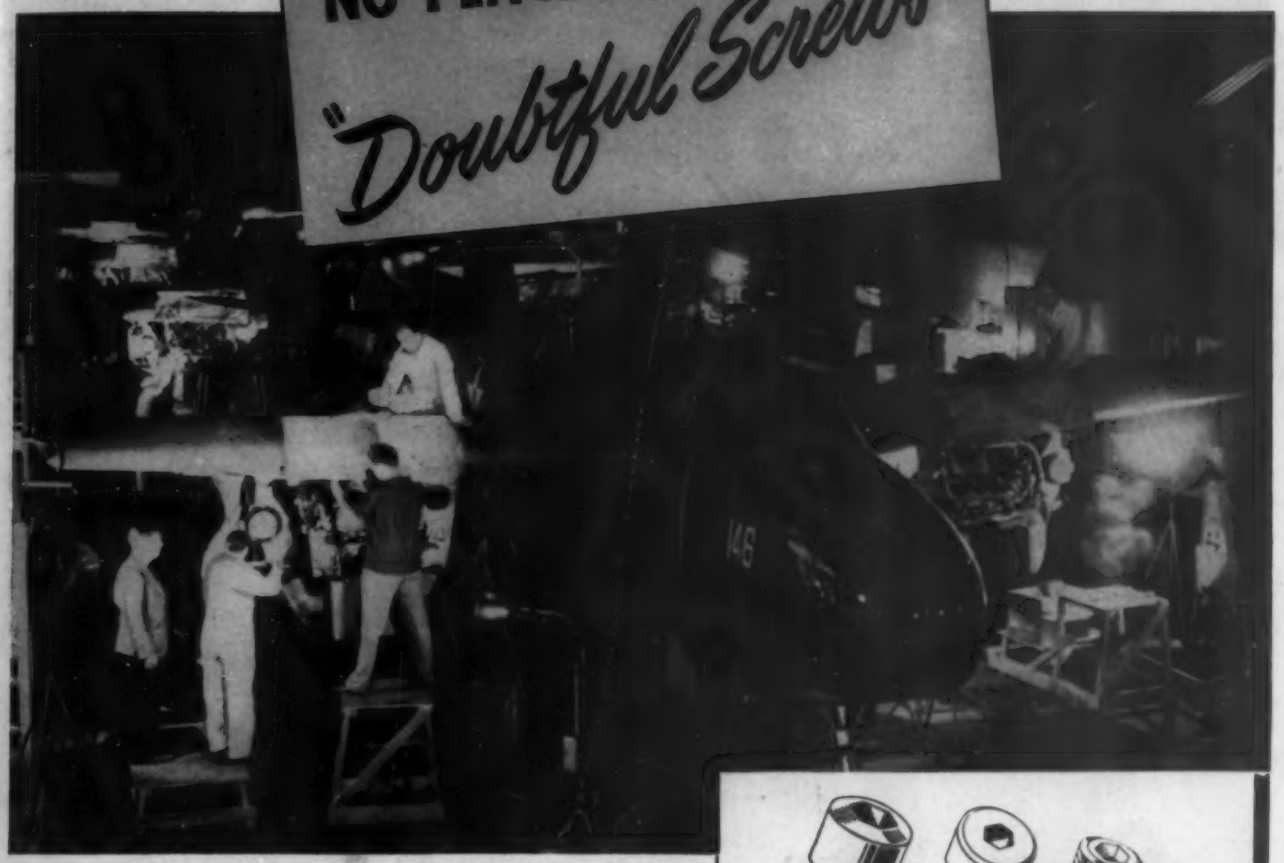
New York—William R. Alley • Philadelphia—Carson, Marshall & Co. • San Francisco, Los Angeles and Seattle—H. L. E. Meyer Jr. & Co.

IRON ORE ★ PIG IRON ★ COAL ★ COKE

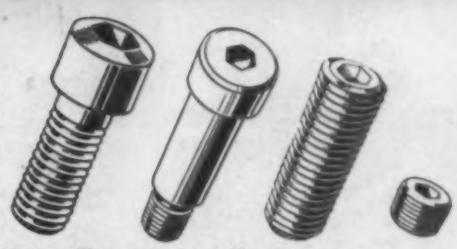
NO PLACE FOR "Doubtful Screws"



—In Fighting Equipment that Must "Take It"!

Allies and enemies alike express amazement over the amount of punishment that American planes and combat cars will take. American engineers and production men have disproved any idea that they couldn't build fast and build well, too. While they've put on night shifts . . . speeded-up in a thousand ways . . . they've refused to take chances with "doubtful materials". And, in their insistence that every integral part must conform to rigid standards, lies the reason why Parker-Kalon Quality-Controlled Socket Screws are "on the preferred list" of so many makers of planes and engines, combat cars and trucks.

P-K Socket Screws have the extra dependability that severe service requires. "Doubtful screws" . . . screws that *look* all right but some of which fail to *work* right . . . are eliminated by the unequalled quality-control routine of the Parker-Kalon Laboratory. This assurance covers all physical and mechanical characteristics . . . yet P-K Screws cost no more. Parker-Kalon Corp., 194-200 Varick St., New York.



"Quality-Controlled" means . . .

Complete test and inspection covering; Chemical Analysis; Tensile and Torsional Strength; Ductility; Shock Resistance under Tension and Shear; Hardness; Head diameter, height and concentricity; Socket shape, size, depth and centricality; and Thread fit.

PARKER-KALON

Quality-Controlled

SOCKET SCREWS

Give the Green Light to War Assemblies

METAL DRILLING MACHINERY

SUPER SERVICE
CB
3' or 4' ARM with 9" COL.
RADIAL
BULLETIN R-21-B
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BULLETIN U-24
• Productivity, Capacity, Adaptability, Reliability, Accuracy, Convenience and Economy are the intangible components that give the Cincinnati Bickford line of drills the appropriate name of SUPER SERVICE.
Examine the possibilities of the machines shown here and for further information send for any or all of the bulletins pertaining to the machines that interest you.
THE CINCINNATI BICKFORD TOOL CO.
OAKLEY, CINCINNATI, OHIO
ARMY E NAVY
AWARDED SEPT 10, 1942
4' ARM 13" COL. to 8' ARM 19" COL.
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21", 24", & 28" ROUND and BOX COL. UPRIGHTS
BULLETIN U-25
THE CINCINNATI BICKFORD TOOL CO.
METAL DRILLING MACHINERY

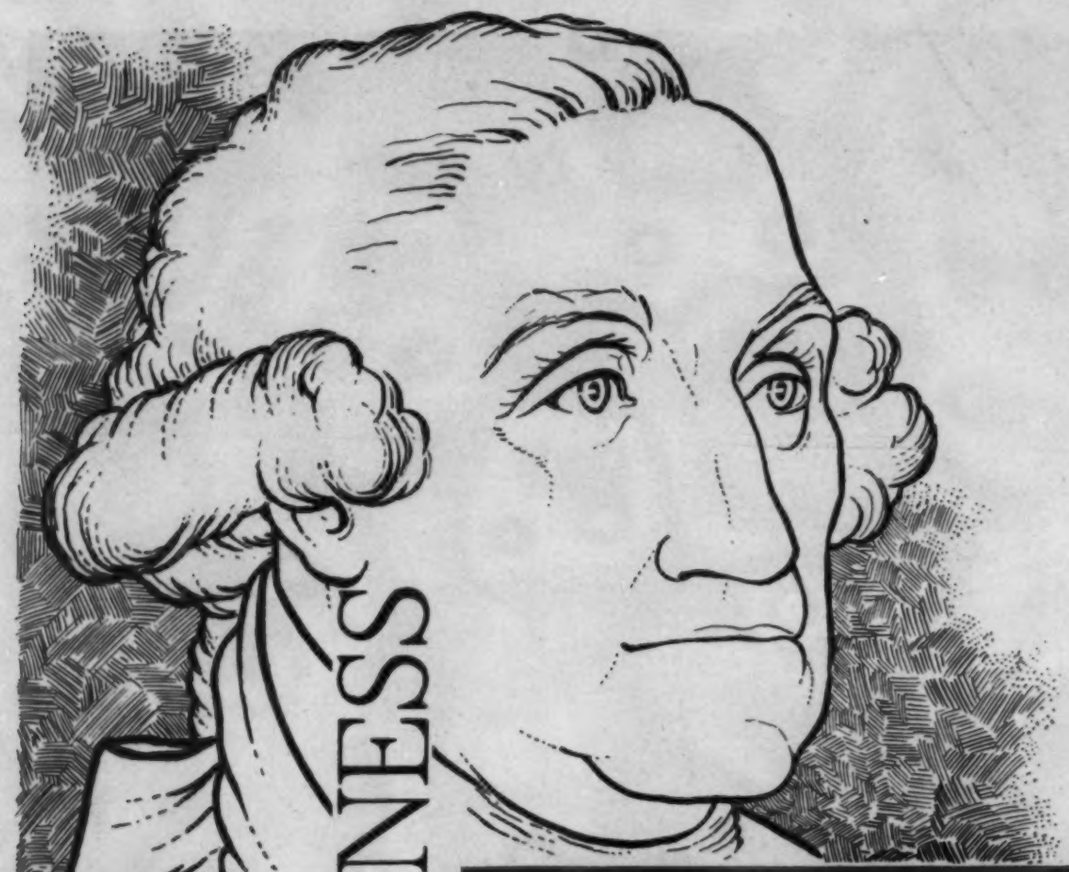
Speed and endurance for Victory now — for profits later.

MACHINES FASTER • WEARS LONGER

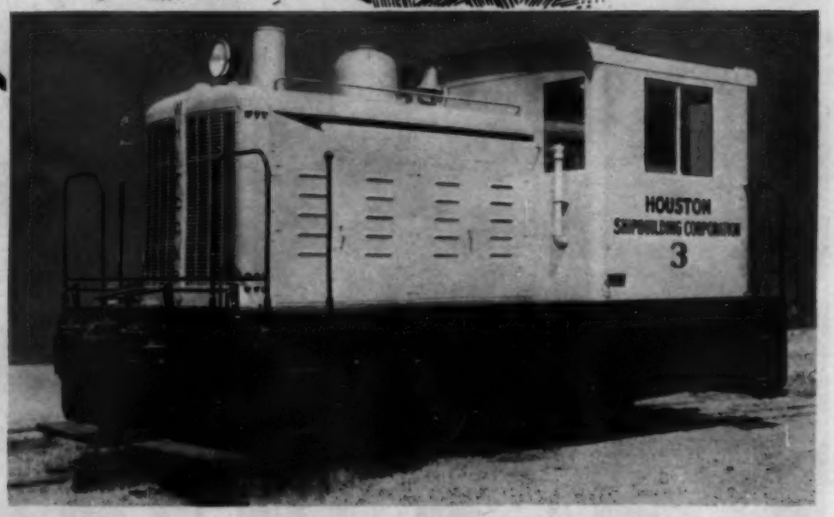
CONSERVES CRITICAL ALLOYS

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

Steel and Tube Division



STEADFASTNESS



In the dark hours of our struggle for Independence, the faith and steadfastness of Washington inspired an infant nation. Those same qualities are terribly important today; they are the foundations of world reconstruction. WHITCOMB locomotives are steadfast in performance, faithful in keeping maintenance costs to a minimum. In an industrial world geared to a staggering production program, WHITCOMB mobile power units are still built on the theory that precision is superior to display, that reputation is worth more than empty words, and that steadfastness, in men or machines, is the root of success.

BLW
THE BALDWIN GROUP

THE WHITCOMB LOCOMOTIVE CO.

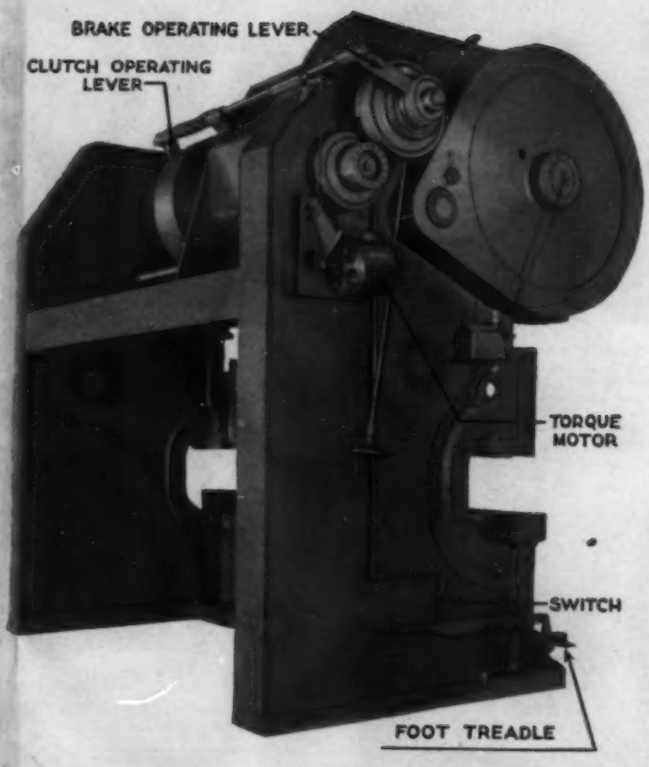
ROCHELLE ILL.

Subsidiary of THE BALDWIN LOCOMOTIVE WORKS

...machine is a Model M6-10 and is designed to bend 10 feet of ¾-inch steel plate between the end housings or plate 12 feet 6 inches wide by ⅝-inch thick over the entire length of bed and ram.

Electrically-operated CLUTCH *and* BRAKE ...EASES OPERATION ...SPEEDS PRODUCTION

ANOTHER STEELWELD DEVELOPMENT



FEATURES that speed production, lower costs, ease the operator's work, increase machine versatility, etc., are continually being pioneered and introduced on Steelweld Presses.

Now the latest — an electrically-operated clutch and brake mechanism to reduce the fatigue of the press operator by eliminating the usual physical effort required to engage the clutch manually. As a result production can be stepped up considerably.

With the new mechanism it is no longer necessary to keep the foot treadle depressed in order that the clutch remain engaged, although this can be arranged if desirable. Snappy clutch and brake action is obtained which reduces the wear considerably because of decreased clutch and brake slippage.

While Steelweld bending presses of all sizes can be furnished with an electrically-operated clutch and brake, this mechanism is particularly desirable for the larger machines that are used for forming plate of ½" to 1" and greater in thickness. The mechanism can be installed on most Steelweld Presses now in service.

GET THIS BOOK!

...G No. 2002 gives complete construc-...d engineering details. Mail request ...copy on your company letterhead.

THE CLEVELAND CRANE & ENGINEERING CO.
STEELWELD MACHINERY DIVISION
1125 EAST 283RD STREET • WICKLIFFE, OHIO.

MANUFACTURERS OF • CLEVELAND CRANES • CLEVELAND TRAMRAIL • STEELWELD BENDING PRESSES

STEELWELD
BENDING PRESSES

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Cuts time up to 75%

ON JOBS PREVIOUSLY HAND SCRAPED

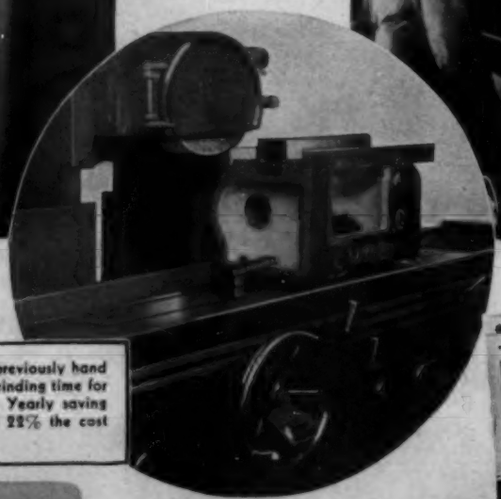
Examples: Time on pump case reduced from 40 hours to 4 hours . . . . . Time cut from 12 hours to 3½ hours on slide castings . . . . . Yearly saving on Housings — 22% the cost of machine, etc.

When added together, time savings like this not only make a big difference in manufacturing cost, but help speed up delivery schedules. To see what Mattison High-Powered, Precision Surface Grinders can do on your work, send us blue prints for production estimates.

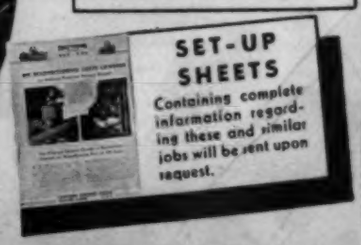
● High Pressure pump case previously finished, planed and hand scraped in from 40 to 48 hours — Now the Mattison Grinder has made these operations unnecessary, reduced time to 4 hours and case comes through with a fine finish and accurate to within .0003".

● Cast iron slide previously rough planed, finish, planed and hand scraped — NOW GROUND on Mattison Grinder (6 pieces per set-up) at an 80% savings in time. Finish planing and scraping operations eliminated.

● Cast iron frame previously hand scraped, NOW GROUND top and bottom of casting, shoulder and inside surfaces. 75% time saving.



● Cast iron Housing previously hand scraped in 8 hours. Grinding time for housing is 2.5 hours. Yearly saving on this job alone was 22% the cost of machine.

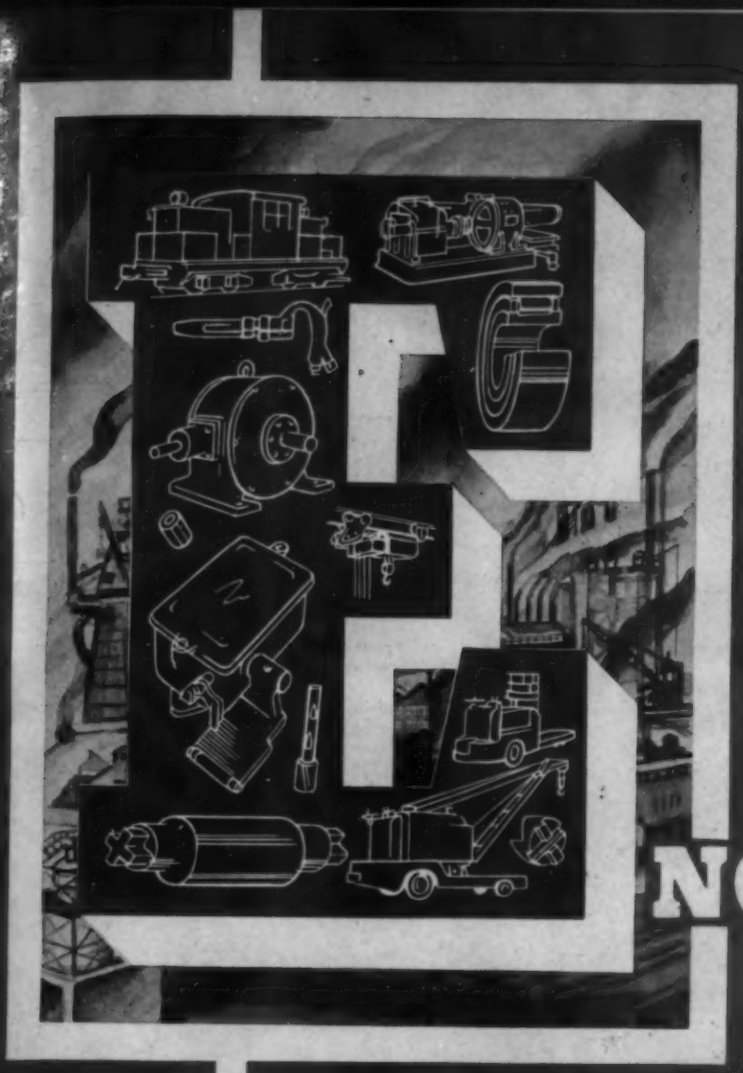


SET-UP SHEETS

Containing complete information regarding these and similar jobs will be sent upon request.

MATTISON MACHINE WORKS

ROCKFORD · ILLINOIS



NGINEERING

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TWO ANSWERS TO MANUFACTURERS' DEMANDS FOR INCREASED SPEED AND UNIFORMITY OF PRODUCTS . . . .

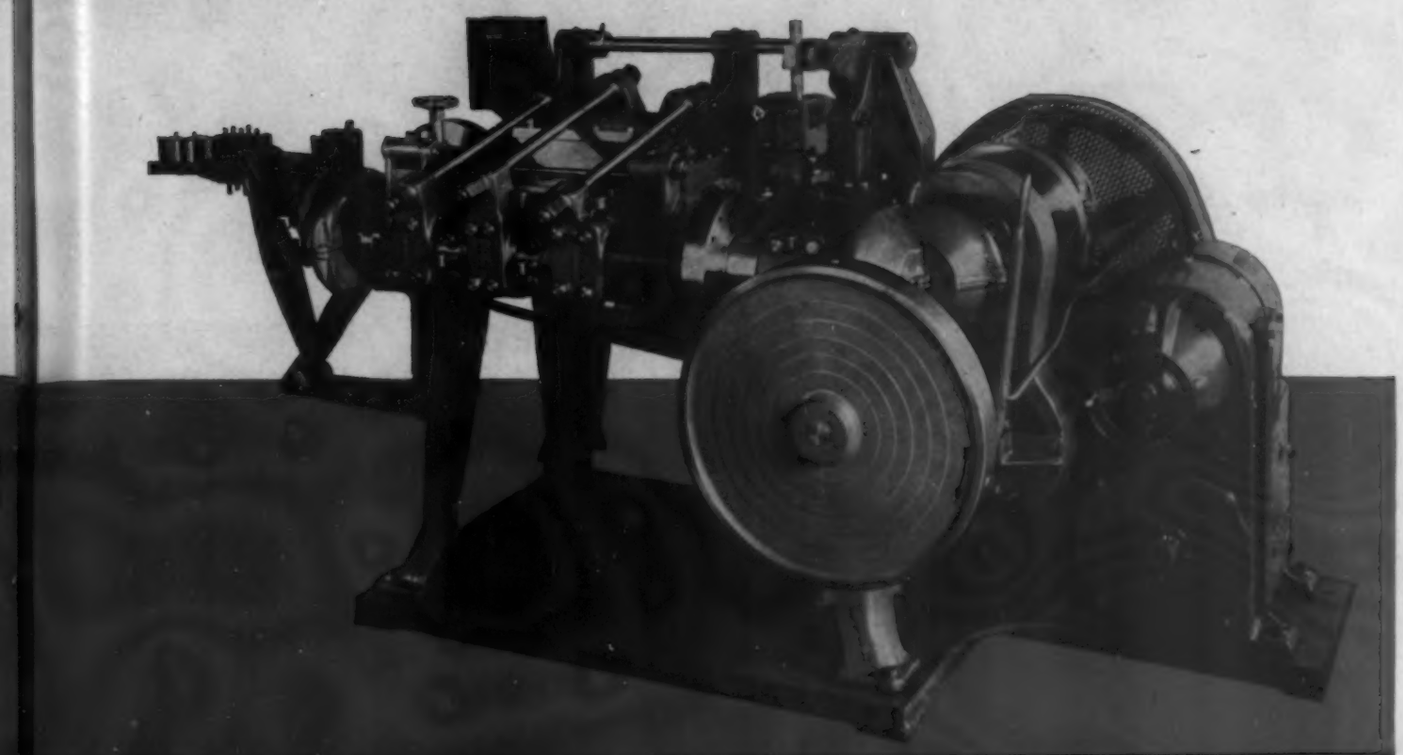
THE NILSON AUTOMATIC STAPLE FORMING MACHINE

Fifty years of special machine design experience is behind this Nilson staple forming machine. Thus, when the demand came for a stapling machine that would produce uniform staples at increased speed, the Nilson No. 2 stapler appeared. It is the plunger type, insuring greater accuracy and speed. It has a special attachment for producing chisel point staples. There is nothing experimental about this machine: it is fully established, and gives the best in low production cost.

THI

The A.H.

BRIDGEPORT, C



THE NILSON AUTOMATIC METAL WIRE FORMING MACHINE

Here is a highly practical and efficient machine for forming wire and punching patterns from ribbon stock. Increased speed and uniformity of products are musts in the matter of reducing manufacturing costs of your product. This Nilson four-slide forming machine meets these conditions. Various patented features and extra attachments make it extremely adaptable, and the skilled labor and perfect workmanship that unite to create this machine insure long life and freedom from repairs and replacements.

.NILSON MACHINE CO.

T, CONN., U. S. A.

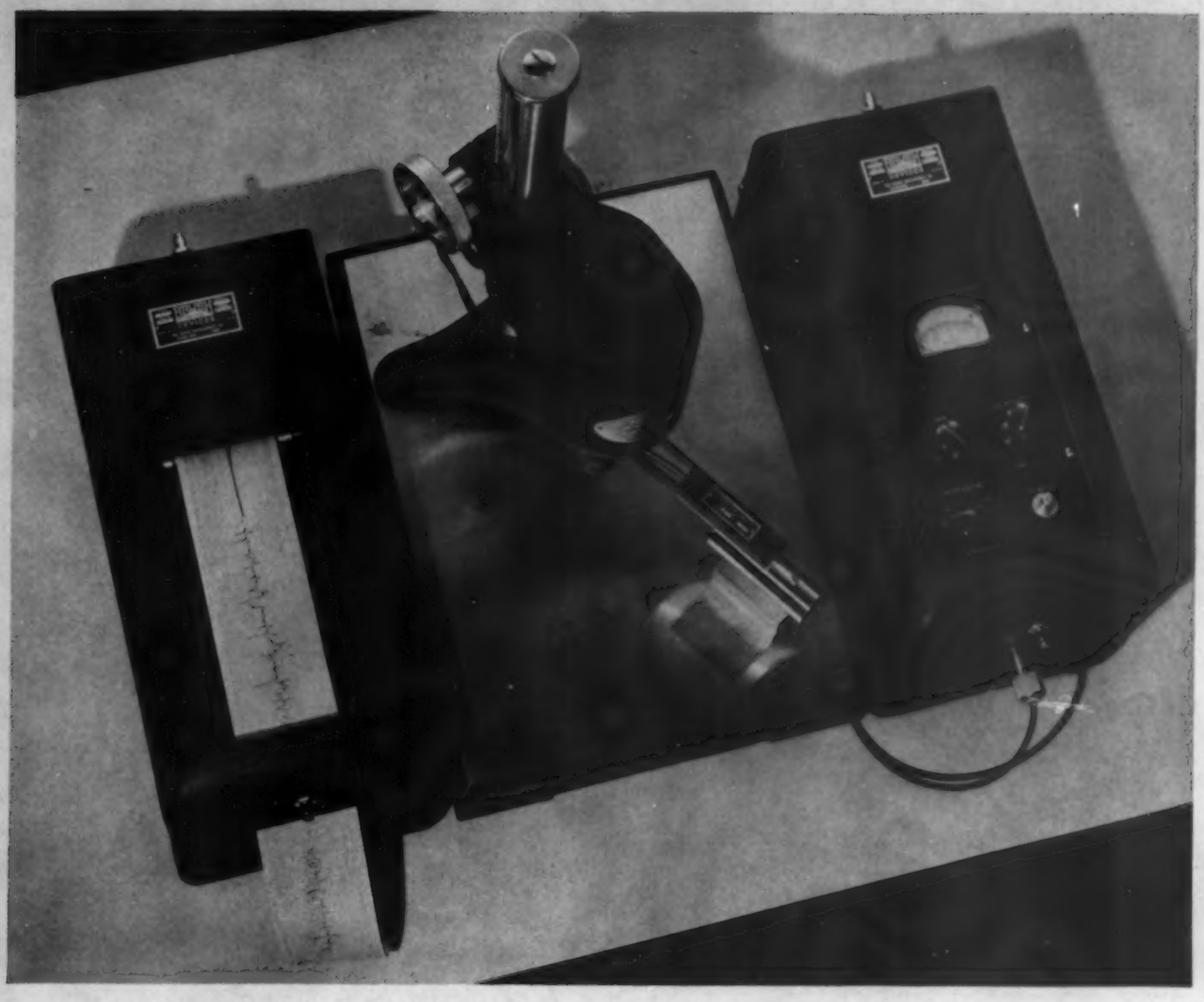
More AND Faster STEEL PRODUCTION

AMCO PIT FURNACES

Steel is the key to war-time production. AMCO Pit Furnaces are doing their part by serving the largest steel producers in the United States and Canada. Operating reports continually show a substantial increase in steel quality, a decrease in chipping costs and a welcome reduction in scale loss, fuel expense and maintenance costs.

Over 160 in active operation and on order; get the facts.

The AMSLER–MORTON Company
FULTON BUILDING PITTSBURGH, PA.

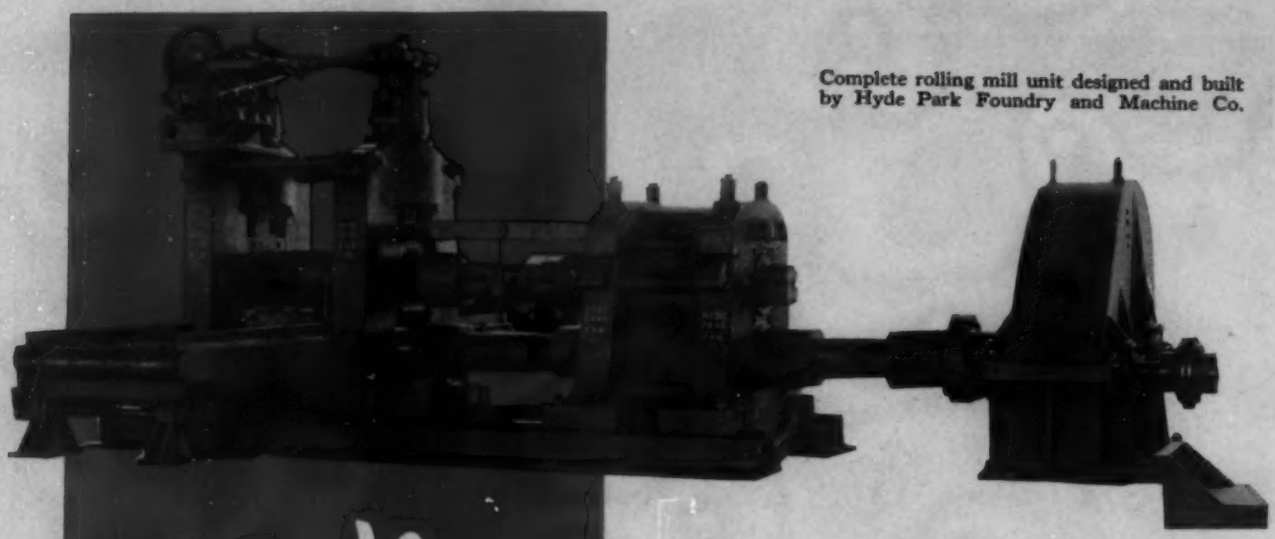


An Armada's in the Making!...

A hundred thousand planes to be built in 12 months. Transports, bombers, fighters—to form the most invincible Armada known. They'll blacken the sky over our enemies and we'll get our Victory and our Peace and our Security.

We need tools—fast, simple, accurate tools to build this Armada. Plane engines must run smoothly—vibrations, stresses and strains must be carefully analyzed, surface finishes constantly checked by men who study these things from graphic recordings as charted by the Brush Direct-Inking Oscillographs and Brush Surface Analyzers.

THE BRUSH DEVELOPMENT CO.
3311 PERKINS AVENUE • • CLEVELAND, OHIO



Complete rolling mill unit designed and built by Hyde Park Foundry and Machine Co.

Hyde Park...

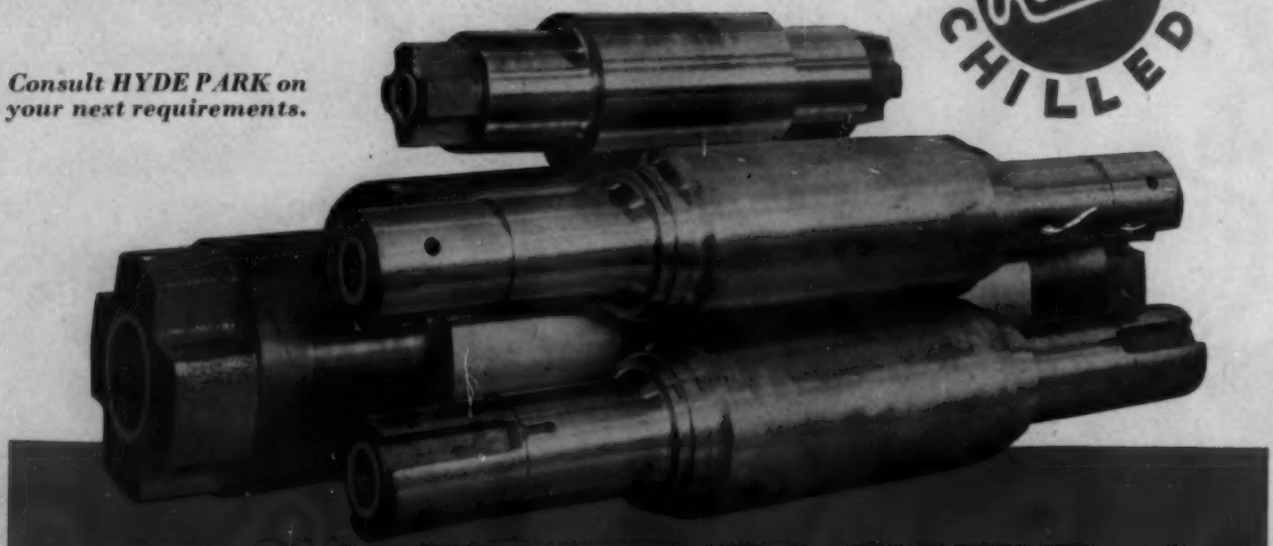
ROLLING MILL MACHINERY and CHILLED ROLLS

HYDE PARK Rolling Mill Machinery includes all kinds of Sheet and Tin Mill Shears, Roll Lathes, Steam Doublers, Sheet Pack Carriers, Stretcher Levellers and Rolling Mill Machinery built to specifications.

HYDE PARK produces the famed "Red Circle" heat treated Alloy and Plain Chilled Rolls for three and four-high Mills, Sheet and Tin Mills, Moly Rolls, Nickel Chilled, Grain Rolls, Cold Rolls and Sand Rolls.

RED CIRCLE Rolls CHILLED

Consult HYDE PARK on your next requirements.

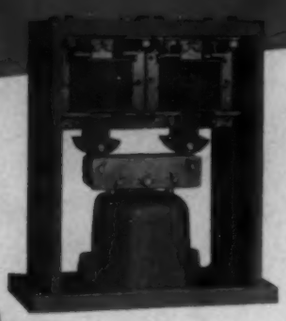


HYDE PARK FOUNDRY AND MACHINE CO.

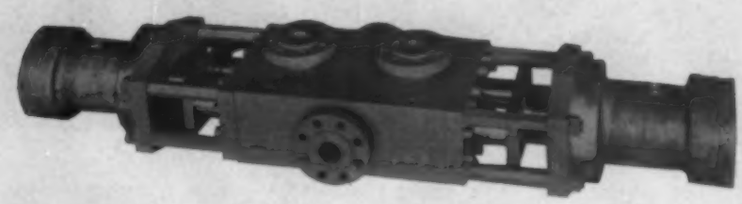
Hyde Park, Pa. (Pittsburgh District)

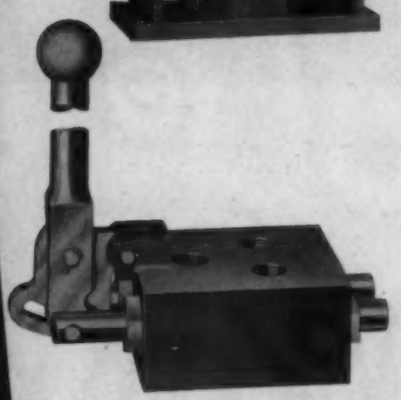
Quick-As-Wink Valves

FOR THE STEEL INDUSTRY



FOR COILERS: Solenoid-operated air valves function quickly and dependably for the control of gates, tilting tables, extractor cylinders on hot-strip coilers.





FOR ROLL BALANCE: Q. A. W. valves provide efficient and reliable control for hydraulic roll balance systems—lever-operated, 3-way, off-and-on exhaust action. Made for any pressure.

FOR FORGING PRESSES: Pilot-operated three- and four-way neutral action hydraulic valves for forging presses. Also used on slab pushers and manipulators.

FOR DESCALING: Designed specifically for descaling operations. A complete range of sizes from 1½ to 6 inches. Standard in the steel industry since 1935.

GENERAL PURPOSE AIR VALVES: Complete range of types and sizes of hand-operated air valves, in all popular actions for control of single and double acting air cylinders.

THE HIGHER THE PRESSURE
AIR
WATER
OIL
THE TIGHTER THE SEAL

C.B.HUNT & SON

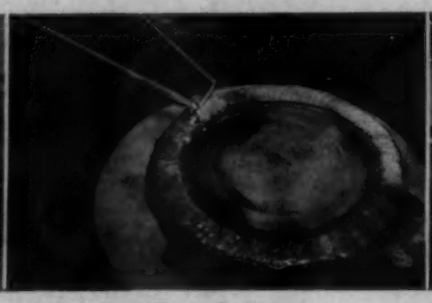
Salem, Ohio

QUALIFIED FIELD ENGINEERS IN ALL PRINCIPAL STEEL MILL DISTRICTS

Products and Services for every Application of the OXY-ACETYLENE Process

MARITIME "M" AWARD FOR OUTSTANDING PRODUCTION ACHIEVEMENT

Oxy-acetylene processes are used throughout industry to speed up production and construction programs, to conserve materials, to lower operating costs, and to simplify problems of maintenance and repair. Some of the many oxy-acetylene applications are outlined here.



Bronze-Welding **Resurfacing** **Hard-Facing**

The oxy-acetylene flame makes possible the joining of practically any metals—like or unlike—so that the weld is as strong as the base metal itself. *Bronze-welding* speeds the repair of cracked or broken steel and iron parts right on the job. *Resurfacing* of worn parts with steel, iron, bronze, or other types of welding rod avoids delays and conserves materials. *Hard-facing* with Haynes Stellite alloys makes parts that are subject to abrasion, heat, or corrosion last from two to twenty-five times longer. Welded piping systems use less fittings, occupy less space, and remain leakproof and maintenance-free indefinitely.

Machine Shape-Cutting

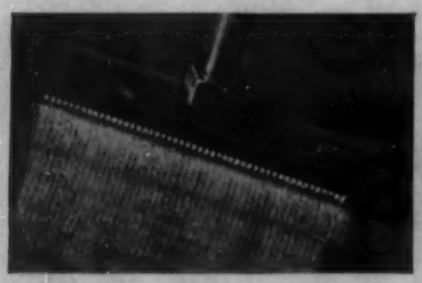
Shape-cutting quickly produces simple or intricate steel shapes with clean-cut edges. This method is also used for bar and billet cut-off, for straight-line cutting, and for preparation of plate edges.

Stack-Cutting

Stack-cutting of tightly clamped piles of plates permits fast production of identical parts. This oxy-acetylene method usually is faster and more economical than shearing or other mechanical methods.

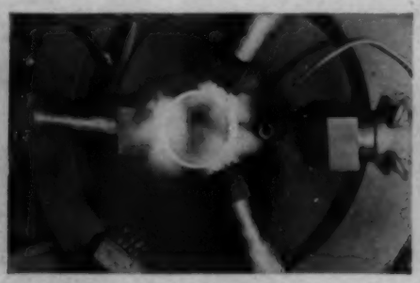
Hand-Cutting

Hand-cutting speeds the cutting of structural steel to length, quickly severs gates and risers and facilitates alteration work. With Oxweld gouging nozzles, a groove of surface metal can be removed.



Flame-Priming

This relatively new process removes loose scale, rust, and surface moisture from steel prior to painting — making paint go on faster, bond tighter and last longer.



Flame-Hardening

This oxy-acetylene process is used to impart a hard, wear-resistant case to steel and iron parts without affecting the toughness of the core or chemical composition of the metal.

Heating

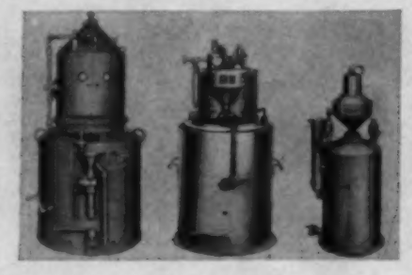
Heating for bending, straightening, and forming operations is facilitated by the intensely hot, easily controlled oxy-acetylene flame. Above a pipe is being wrinkle-bent.

Hand Apparatus

Oxy-acetylene apparatus which may be ordered from Linde includes oxy-acetylene blowpipes for all welding and heating work; oxy-acetylene cutting blowpipes, cutting attachments, and nozzles; and oxy-acetylene descaling and flame-priming equipment. Oxweld apparatus is supplied from Linde offices and warehouses. The Purox and Prest-O-Weld line are distributed by industrial and automotive jobbers. Prest-O-Lite air-acetylene appliances for soldering and brazing are also distributed by these jobbers.

Welding Rods, Fluxes, and Supplies

Oxweld welding rods and fluxes are of exceptionally high quality. The many kinds and sizes of Oxweld rods make it possible to select the one that will give best results on each job. The Oxweld line also includes gloves, goggles, lighters, hose, ferrules, and asbestos paper. Rods, fluxes, and supplies may be ordered from Linde, or from automotive and industrial jobbers.



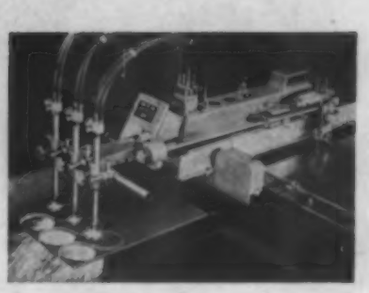
Generators and Manifolds

Oxweld acetylene generators produce low-cost acetylene and are made for both portable and stationary use—with maximum generating capacities of from 30 to 6,000 cu. ft. per hour. Oxweld oxygen and acetylene manifolds are used for centralizing the oxygen and acetylene supply from cylinders.

Send for This Catalog

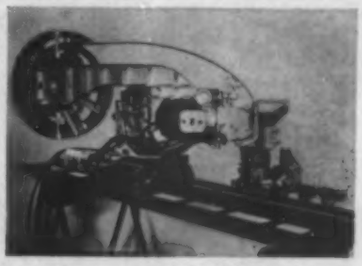
For a more detailed description of Linde processes and services, send for the booklet shown here. Catalogs describing oxy-acetylene generators, manifolds, hand and machine-cutting apparatus, Oxweld welding rods, fluxes, and supplies, also are available upon request. Specify the type of product in which you are interested.

Machine Apparatus



Included in the complete line of Oxweld apparatus are portable and stationary oxy-acetylene shape-cutting machines; straight-line cutting machines; flame-hardening apparatus; bar and billet cut-off machines; equipment for automatic welding; and tractor units for plate-edge preparation.

Unionmelt Welding



This unique electric process makes high-quality welds in any commercially used thickness of steel — in one pass—at high speeds — and without flash, glare, or sparks. The process is fully automatic. Speed and current values are established by electric controls adjusted by an operator. This process is used extensively in fabricating such equipment as ships, pressure vessels, locomotives, and pipe.

Process Literature

Linde makes available to customers a library of process literature which contributes to the knowledge of operators and shows how to use the oxy-acetylene process profitably.

Oxygen—Acetylene—Carbide

Linde oxygen, Prest-O-Lite acetylene, and Union Carbide are distributed through Linde plants and warehouses located to assure dependable deliveries and low transportation costs.

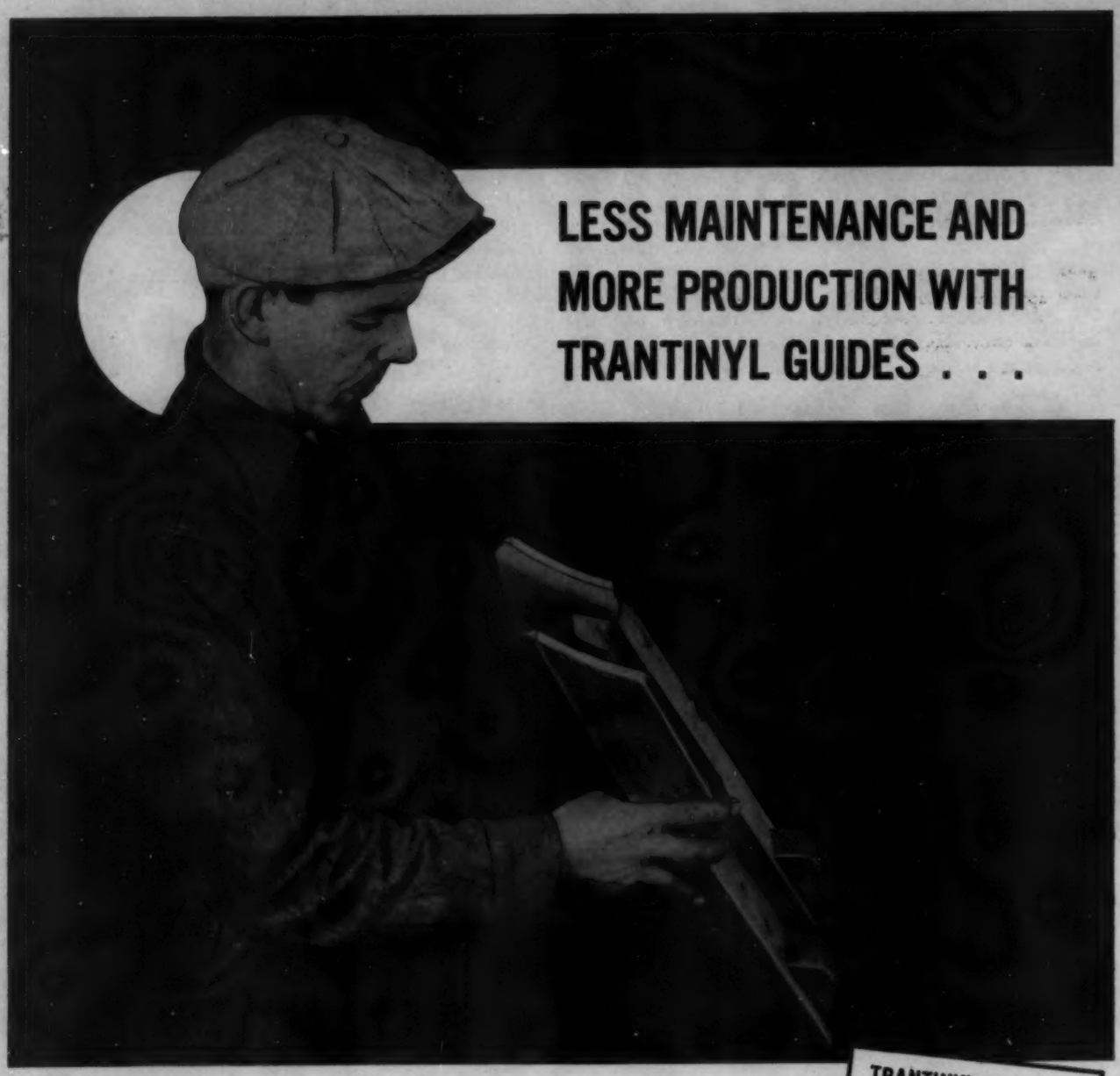
The words "Linde," "Prest-O-Lite," "Union," "Oxweld," "Purox," "Prest-O-Weld," "Haynes Stellite," and "Unionmelt" are trade-marks.

THE LINDE AIR PRODUCTS COMPANY

Unit of Union Carbide and Carbon Corporation

30 E. 42nd St., New York, N. Y. UCC Offices in Principal Cities

In Canada: Dominion Oxygen Company, Limited, Toronto



LESS MAINTENANCE AND MORE PRODUCTION WITH TRANTINYL GUIDES . . .

● It is important that Trantinyl guides are precision cast. Smoothness of surface, definition, and feather-edge points free from cold shots, permit production of record-breaking tonnages without scoring of the rolls. Furthermore, Trantinyl guides provide improved yield of higher quality products with reduced cost per ton. You'll find them worth-while.

TRANTINYL TONNAGE RECORD BREAKERS

Seamless Tube: Guide Shoes, Rolling Mill Plugs, Stripper Guides. **Bar Mills:** Guides, Rollers. **Hoop Mills:** Slitter Guides, Feed Rollers. **Billet Mills:** Rollers Guides. **Strip Mills:** Guides, Uncoiler Wearing Plates (Cold Strip). **Shape Mills:** Rollers, Guides. **Welded Pipe:** Rolls.

YOUNGSTOWN ALLOY CASTING CORPORATION

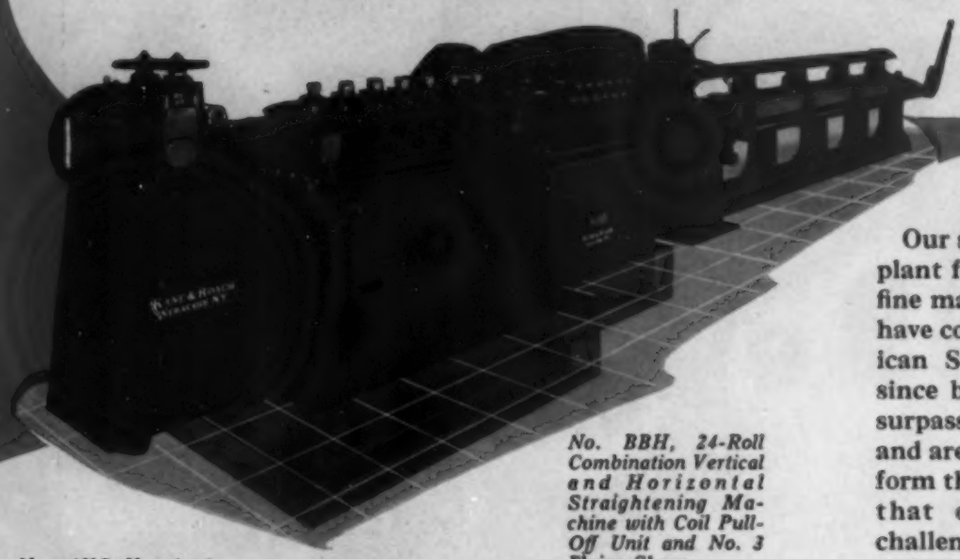
Youngstown, Ohio, U.S.A.

"Get Out the Work!"

...A Wartime Challenge We're Answering with NEW ACHIEVEMENTS

KANE & ROACH

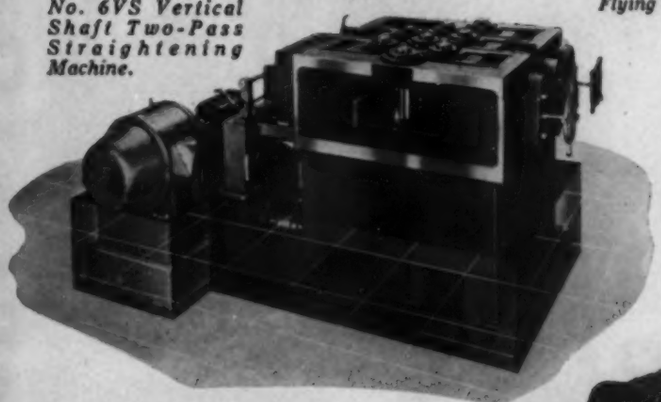
Manufacturers since 1887 of Straightening Rolls...Bending Rolls...Edging Rolls...Gang Slitters ...Cold Roll Forming Machines...Crimping Machines...War Materials — Sub-Contracting

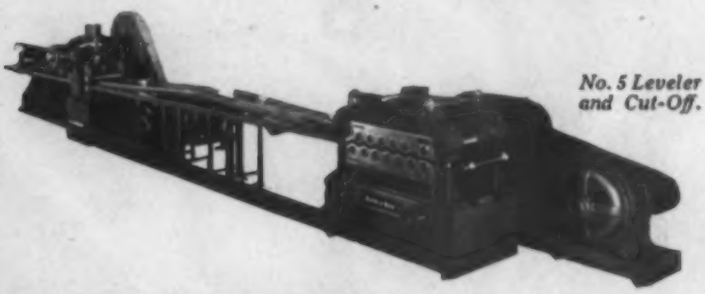


No. BBH, 24-Roll Combination Vertical and Horizontal Straightening Machine with Coil Pull-Off Unit and No. 3 Flying Shear.

Our skilled workers . . . our unique plant facilities . . . our knowledge of fine machining . . . which since 1887 have contributed much to the American Steel Industry—all have long since been called to arms. We have surpassed all our previous records... and are now doing our utmost to perform the biggest job in K&R history, that of answering our nation's challenge for *more*, and then *some MORE*, material for our armed forces.

No. 6VS Vertical Shaft Two-Pass Straightening Machine.

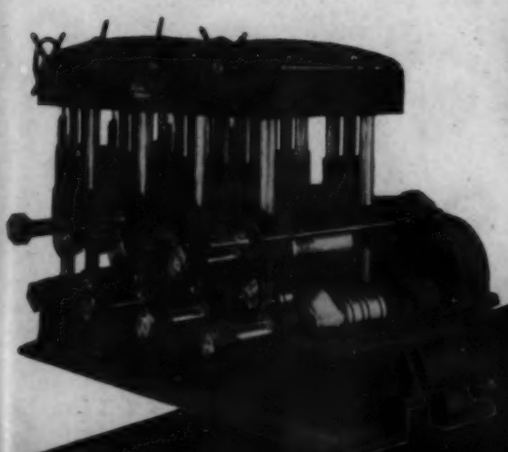




No. 5 Leveler and Cut-Off.

No. 2AH, 24-Roll Combination Horizontal and Vertical Straightening Machine, Type A.

No. 5250B, 5-Roll Rotary Straightening Machine.



No. 6 Standard 8-Roll Straightener.

K&R

KANE & ROACH

SYRACUSE, N. Y., U. S. A.

Established 1887

Huther circular metal cutting saws, inserted segment type and solid type, Huther metal cutting band saws described in this catalog. Also tungsten carbide tipped saws for cutting copper and aluminum. Catalog No. 60 sent on request.

HUTHER BROS. SAW MFG. CO.

Inserts For Fine Pitch Saw

Patented October 25, 1902; January 19, 1915

The view above shows four of the different sizes of teeth used in the fine pitch type of Huther Bros. Patent Milling Saws.

The two inserts at the left were taken from a saw that had been in continuous use for some time without having broken insert.

The wear is equal to about two inches on the diameter and the special heat treatment given these inserts—which are the best quality high speed steel—insures longer runs between sharpenings.

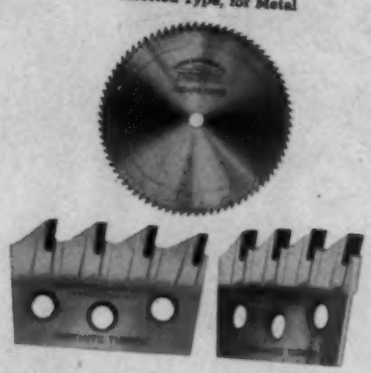
This is a saw that means real economy for the user. May be sharpened on automatic saw sharpener.

74

HUTHER BROS. SAW MFG. CO.

Firthite Tipped Saw

Inserted Type, for Metal



FIRTHITE-TUNGSTEN CARBIDE is used for tipping this Saw. Saw is made especially for cutting non-ferrous metals, fibres, plastics, etc. Write for full information.

75

HUTHER BROS. SAW MFG. CO.

Huther Bros. No. 2 Saw Sharpener

Universal Saw Tooth Grinder

This grinder, while designed primarily to sharpen saw fine and coarse pitch types of metal cutting saws, can be used to sharpen any of the familiar types of teeth in metal cutting saws. While this is not an automatic grinder, it is so simple in operation and set-up, that the average operator can sharpen a saw quicker than by the automatic machine.

Where the small user of saws does not want to go to the expense of an automatic, this is the logical saw sharpener.

78

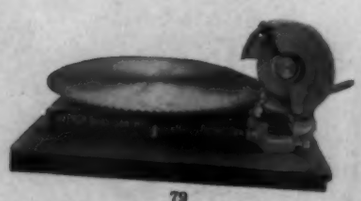
HUTHER BROS. SAW MFG. CO.

Huther Bros. No. 2 Saw Sharpener

PATENTED • Made by HUTHER BROS.

This saw sharpener can be used for sharpening both coarse and fine pitch metal cutting saws, inserted tooth type, also for sharpening solid milling saws. Sharpens both alternate bevel teeth and straight teeth. Any space teeth from ¼-inch up can be used with or without index.

*Furnished With or Without Motor Drive

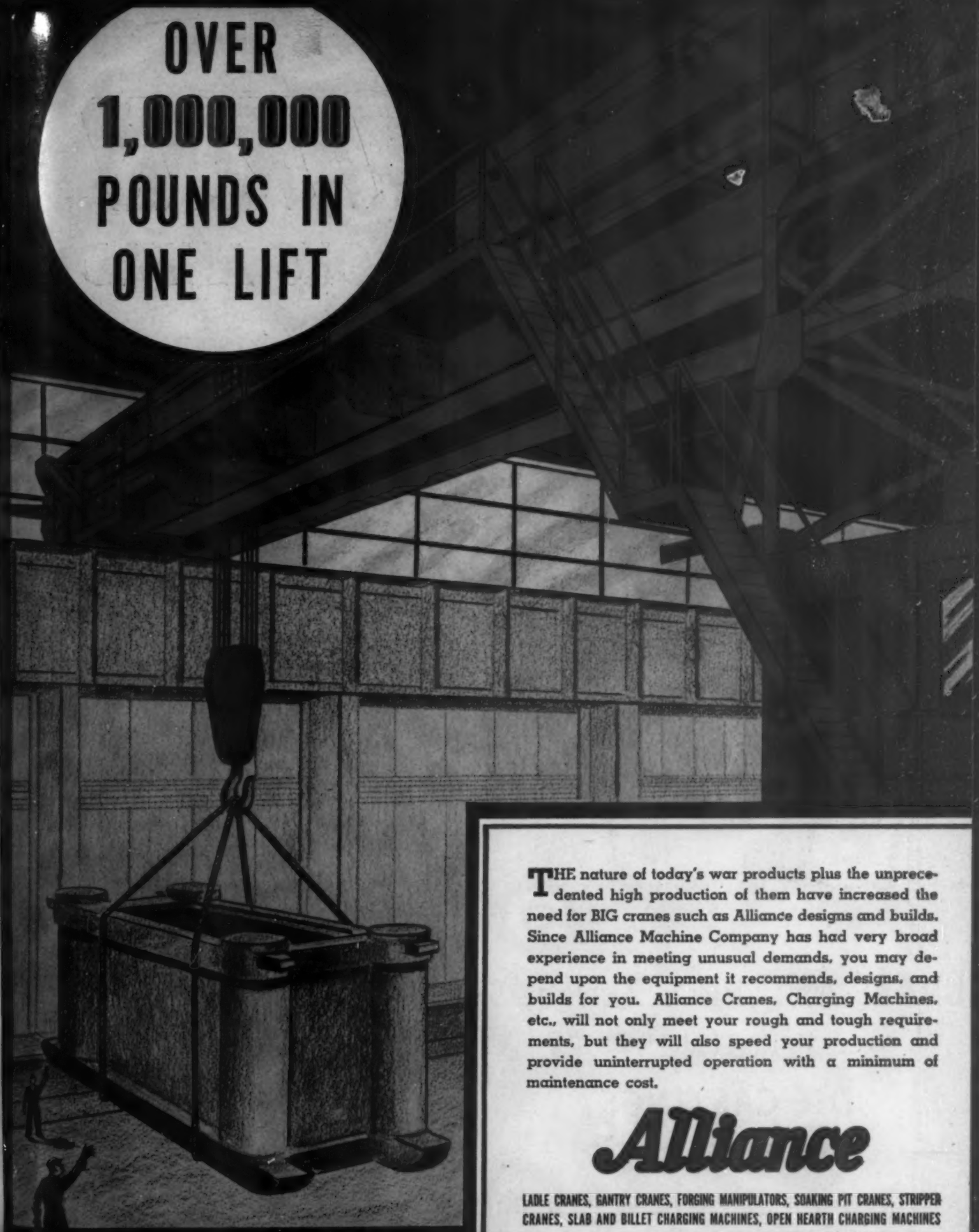


79

Huther Bros.
Saw Mfg. Co., Inc.
1290 University Ave.
Rochester, N.Y., U.S.A.

Saw Makers for over 60 Years

OVER 1,000,000 POUNDS IN ONE LIFT



THE nature of today's war products plus the unprecedented high production of them have increased the need for BIG cranes such as Alliance designs and builds. Since Alliance Machine Company has had very broad experience in meeting unusual demands, you may depend upon the equipment it recommends, designs, and builds for you. Alliance Cranes, Charging Machines, etc., will not only meet your rough and tough requirements, but they will also speed your production and provide uninterrupted operation with a minimum of maintenance cost.

Alliance

LADLE CRANES, GANTRY CRANES, FORGING MANIPULATORS, SOAKING PIT CRANES, STRIPPER CRANES, SLAB AND BILLET CHARGING MACHINES, OPEN HEARTH CHARGING MACHINES

THE ALLIANCE MACHINE CO.

ALLIANCE, OHIO

TITAN
LOOKS AHEAD

● The Titan Metal Manufacturing Company started production in the first World War.

Today we again take pride in serving our Country in time of trial and danger, looking ahead with courage; courage based not on blind optimism, but rather on a full recognition of the tremendous task ahead, coupled with quiet determination.

At Titan we are working the clock around, producing at maximum capacity, enlarging our facilities, conducting continuous metallurgical research,—in short, taking every step possible to produce maximum quantities with concurrent maximum quality.

BRASS AND BRONZE RODS
FORGINGS
DIE CASTINGS
WELDING RODS

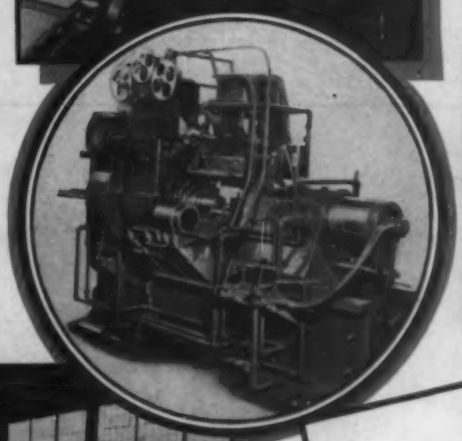
TITAN
METAL MANUFACTURING CO.
BELLEFONTE, PA.
A Great Name in Bronze Since 1915

The WEAN

ENGINEERING COMPANY, Inc. • WARREN, OHIO

SPECIALISTS IN SHEET, TIN AND STRIP MILL EQUIPMENT

- SHELL and SLEEVE LATHE
- WILSON TUBE ANNEALING FURNACE
- ARMOR PLATE LEVELLER
- SLITTER or SIDE TRIMMER [Combination type]
- WEAN-HALLDEN HI-SPEED TIN PLATE SHEARING LINE
- ELECTROLYTIC and BONDERIZING TIN PLATE EQUIPMENT



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Subsidiary Company

THE BRODEN CONSTRUCTION CO.
CLEVELAND, OHIO

SUPPORT OUR FIGHTING FORCES Buy War Bonds

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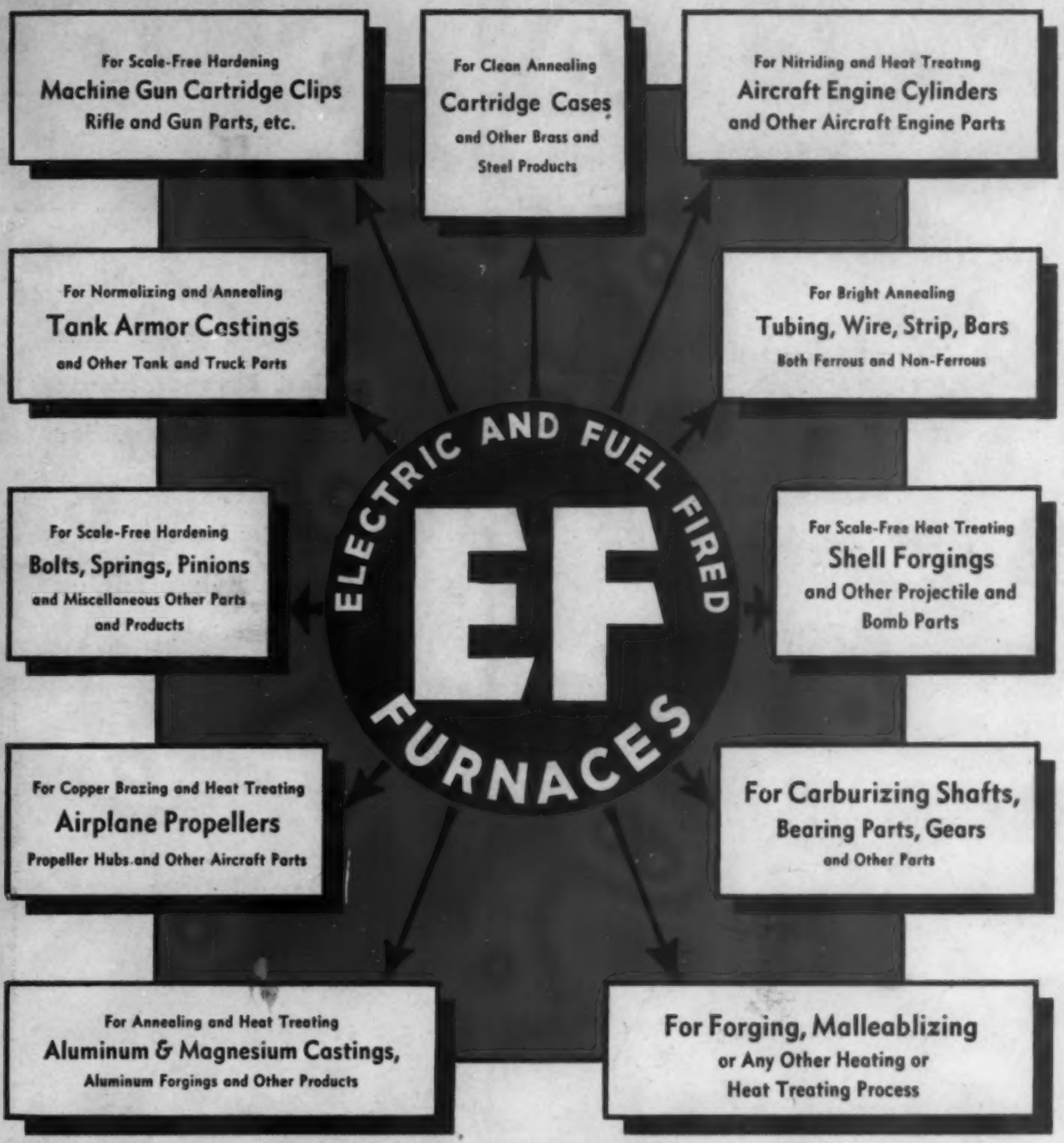
RUGGED!
KEMPSMITH
NO. 2 U
Kempsmith Millers have what it takes for today's grim battle of production . . . built-in ruggedness . . . increased range of speeds and feeds . . . greater power.
KEMPSMITH MACHINE CO.
MILWAUKEE, WIS., U. S. A.
KEMPSMITH
• Precision Built Milling Machines Since 1888 •



Increased production and uniformity; the saving of valuable time, labor and metals and other advantages have been effected by recent EF continuous automatic, semi-continuous and batch type furnace installations.

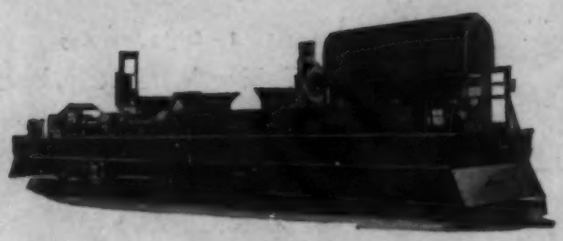
The Electric Furnace Co. specializes in designing and building production furnaces and time and labor saving material handling equipment. Years of practical furnace building experience have enabled EF engineers to develop some outstanding production furnaces for handling the above materials and many other essential war products.

Submit *your* production furnace problems to EF engineers. Phone 4661, Salem, Ohio.

The Electric Furnace Co., Salem, Ohio

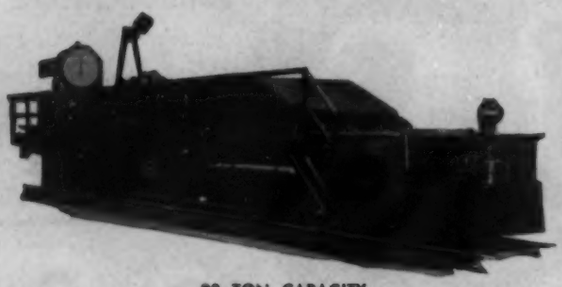
Gas Fired, Oil Fired and Electric Furnaces---For Any Process, Product or Production

Atlas SCALE CARS AND *Atlas* SCALES



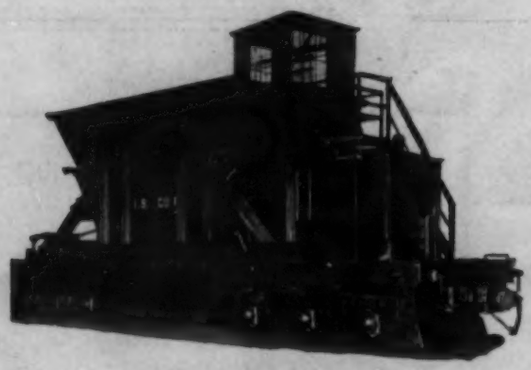
20 TON CAPACITY
DOUBLE COMPARTMENT SCALE CAR

Orr type Bin gates
controlled from operator's station on scale car.



20 TON CAPACITY
DOUBLE COMPARTMENT BOTTOM DUMP SCALE CAR

Scale of All Steel construction equipped
with Atlas Indicating Dial and Recorder.



100 TON CAPACITY GABLE BOTTOM
SIDE DUMP CAR

6-wheel trucks of welded steel construction and provided with self aligning roller bearings. Operator's cab is at an elevated position, where loading, as well as the movements of the car, can be observed. Bottom of the hopper and discharge gates are equipped with electrically operated heaters to prevent freezing of material in severe weather.

Atlas Scale Cars are considered standard equipment in most modern Blast Furnace Plants throughout the world. Atlas Electrically operated Scales and Recorders for automatic coke weighing are rapidly attaining this same distinction.

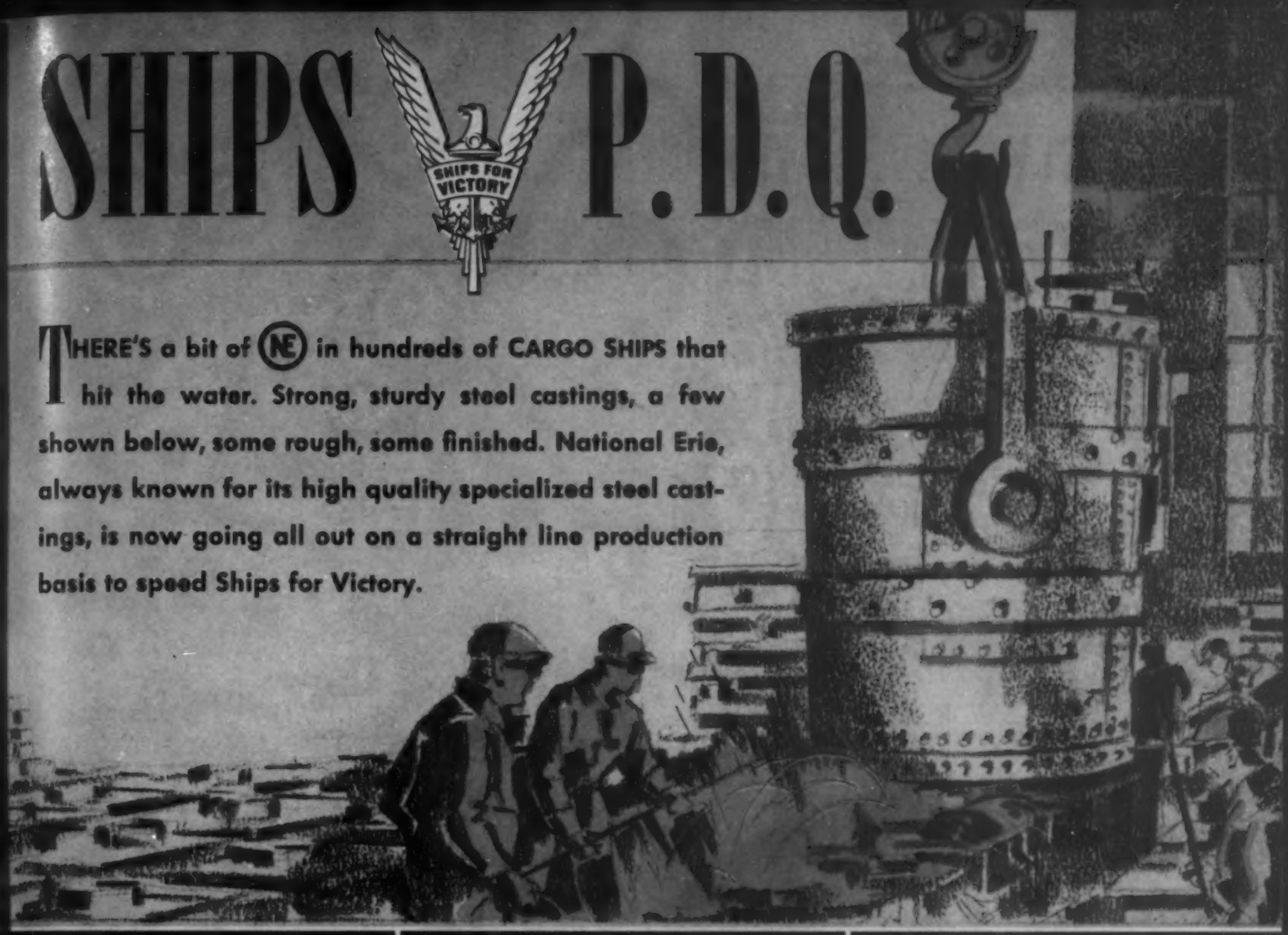
- Atlas 24" Diameter Indicating Scale Dial with chart type recorder. Equipped with new outside adjustable mercury switch tripping contact for automatic coke weighing service.

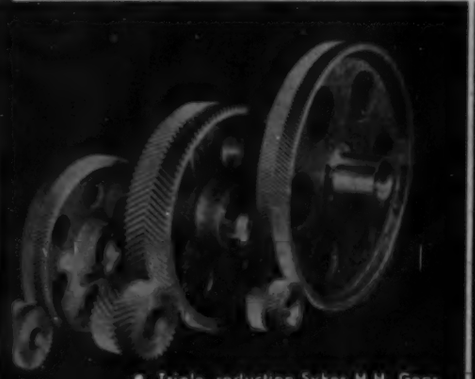
THE ATLAS CAR AND MANUFACTURING CO.
CLEVELAND, OHIO • U. S. A.

SHIPS P.D.Q.

SHIPS FOR VICTORY

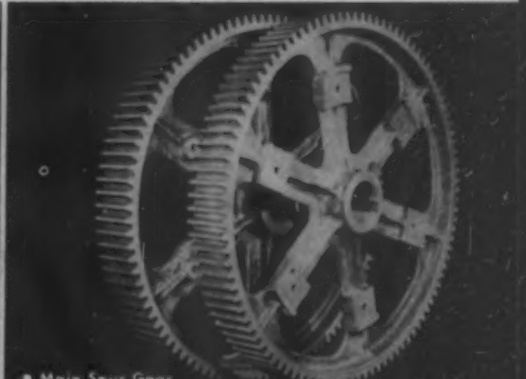
THERE'S a bit of NE in hundreds of CARGO SHIPS that hit the water. Strong, sturdy steel castings, a few shown below, some rough, some finished. National Erie, always known for its high quality specialized steel castings, is now going all out on a straight line production basis to speed Ships for Victory.





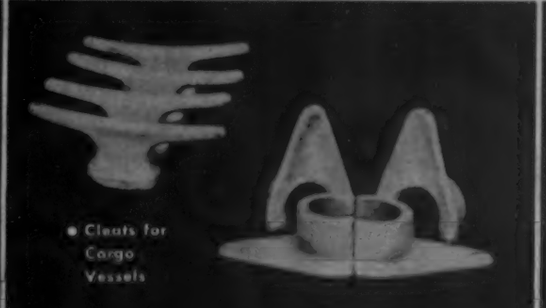
• Triple reduction Sykes H.H. Gear Drive for Two-Speed Cargo Winches

• Crank End Box and Cap for Main Crankshaft Bearing of Engines in the Liberty Ships

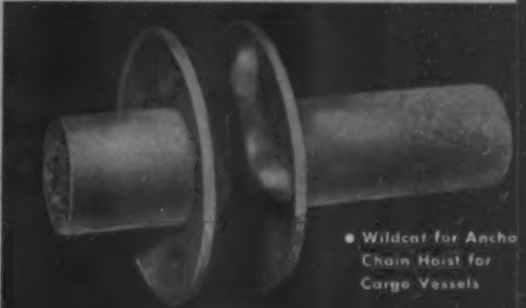


• Main Spur Gear in Steam Winches for Cargo Vessels

• Water Cylinder for Powder Press



• Cleats for Cargo Vessels



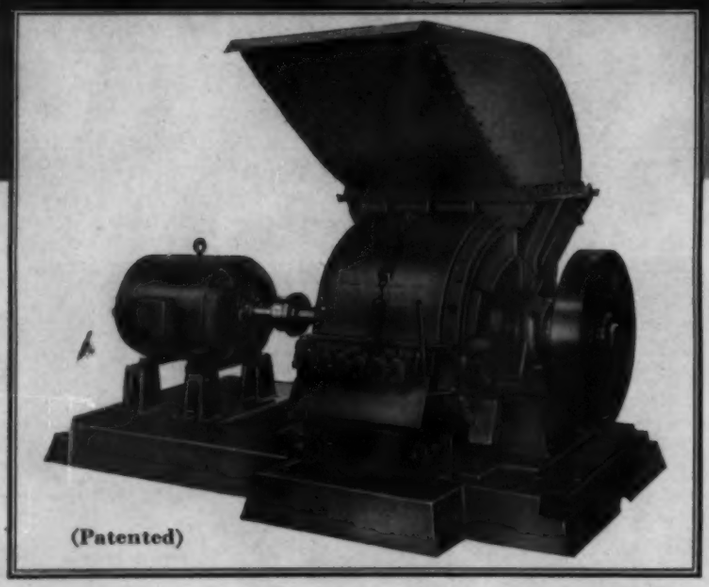
• Wildcat for Ancho Chain Hoist for Cargo Vessels

NATIONAL ERIE CORPORATION

ERIE, PA. U. S. A.

The Insignia of Quality

CLEVER IDEAS ARE SIMPLE WHEN THEY ARE EXPLAINED



(Patented)

The motorcycle daredevil of amusement park fame illustrates the rolling ring crushing principle originated by the American Pulverizer Co. Centrifugal force keeps the motorcycle pressed to the vertical wall. Now, if the rider were to fix manganese steel teeth to his wheels, you can imagine what the walls of the motordrome would look like. The American Ring Turnings Crusher is built on this principle. Four rows of wheels, or rings, each equipped with 24 cutting edges, or teeth, whirl thru the turnings that are fed into the hopper. In contact with solid chunks of metal the rings are momentarily deflected from their usual grinding course, as they are free at all times to swing back out of position. Long curly turnings of low or high carbon steel, alloy steel or brass are reduced by this crusher into a product known as "Chips" or shovelling turnings. These chips bring a higher price, are easier to handle, require less storage space and are easier to ship. The American Ring Turnings Crusher pays for itself in a very short time. Repeat orders demonstrate its utility and superiority. These crushers are built in several sizes. We will be glad to make a study of your requirements and recommend the proper size crusher for your particular needs. Literature sent on request.

ORIGINATORS OF THE ROLLING RING CRUSHING PRINCIPLE

AMERICAN PULVERIZER CO.

1539 MACKLIND AVE., ST. LOUIS, MISSOURI

Representatives in principal cities

PRECISION MADE ...Endurance Tested!

CJB AHLBERG Master BALL BEARINGS All types

Today the need is for faster and increased production—hence a greater necessity for more efficient and definitely reliable equipment. An anti-friction bearing must be made to endure under high speeds and great loads. (CJB) Master Ball Bearings have built into them the quality to "take it".

For every need and any speed—for new or modernized equipment, Ahlberg (CJB) Ball Bearings, Ball Bearing Pillow Blocks and Bower "Super-Finished" Roller Bearings will qualify! THEY ARE ALL "DEPENDABILT"!

The large balls (as well as the deep-grooved rings) in (CJB) Ball Bearings insure extra capacity; their mirror-sheen finish means smooth, silent and enduring operation. The mounted units have rugged cast housings, improved seals and precise alignment features. The Bower Roller Bearing raceways are "Super-Finished" to 3-millionths-of-an-inch accuracy for permanent close adjustment and quiet operation.

Single Row—Light, Medium and Heavy Series
Standard dimension. Also made in inch bore and tapered bore series.

Double Row—Light, Medium and Heavy Series
Maximum ball type. Heavy Thrust capacity.

Self-Aligning Bearing—Light, Medium and Heavy Series
Standard dimension, inch bore, and also made in tapered bore series.

Self-Aligning EC Series
Made to fit standard shafting. Double set screw lock.

Simplex Machine Units, EC Series
$\frac{7}{16}$-2$\frac{7}{16}$-in. shaft sizes Double set screw shaft lock.

ED Series Pillow Blocks
Extra light pillow blocks. $\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, $\frac{15}{16}$, 1, 1$\frac{1}{16}$, 1$\frac{7}{16}$-in. shaft sizes.

EC Series Pillow Blocks
Light duty full self-aligning bearing, unit type housing. $\frac{7}{16}$ to 2$\frac{7}{16}$-in. shaft sizes.

93000 Series Pillow Blocks
Medium duty with adapter type shaft lock. 1$\frac{7}{16}$ to 3-in. shaft sizes.

FEC Series Flange Units
Full self-aligning ball bearing. Shaft sizes, $\frac{7}{16}$ to 2$\frac{7}{16}$ in.

TEC Adjustable Take-Up Units
Self-aligning ball bearing. Shaft sizes $\frac{7}{16}$ to 2$\frac{7}{16}$ in.

TF Take-Up with Steel Screw Adjustment Frame
Ball bearing equipped. Shaft sizes $\frac{7}{16}$ to 2$\frac{7}{16}$ in.

Ball Thrust Bearing
Light, Medium and Heavy series made in standard and self-aligning types.

Bower Tapered Roller Bearings
Available in standard sizes, for production and replacement. Raceways are superfinished for quiet operation.

MANUFACTURERS OF (CJB) BALL BEARINGS AND (CJB) PILLOW BLOCKS

AHLBERG BEARING COMPANY

Manufacturers of (CJB) Master Ball Bearings

★ 3015 WEST 47th STREET • CHICAGO, ILL. ★

SERVICE! ★

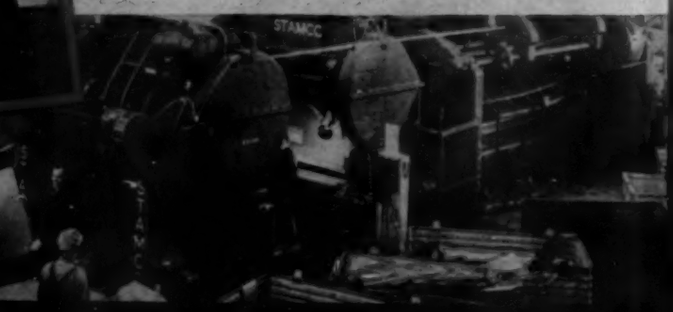
The above illustrated types and many others are available thru 20 direct sales offices and hundreds of Mill supply houses. Engineering assistance is available for intricate problems and modernization programs.

Build 'em fast America!

ALCOA's rapidly increasing output of sheet aluminum for aircraft production has been facilitated by

STAMCO
SHEARS

For Accuracy, Production and Economy Use Stamco Automatic Shear Lines.



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The STREINE TOOL & MANUFACTURING COMPANY

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New Booklet
helps solve handling problems

Quick Answers
to important questions like these

Am I eligible for an industrial truck or tractor under W. P. B. Limitation Order L-112? How do I go about ordering? What equipment is available? When can I expect delivery? Which type of equipment will best serve my needs?

For the vitally important job of keeping materials moving in your plant, you'll find invaluable the data contained in the new Mercury Reference Catalog.

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You've Got to Know the Angles to Keep Shifts Running 'Round the clock and 'Round the Week

HERE THEY ARE...Right Angled Loading for ALL THRUST Bearings

TYPE DT DOUBLE ACTING THRUST

for slow-speed service or for higher speeds where thrust is not reversed frequently.

and- Right-Angled Loading for ALL RADIAL Bearings

TYPE MCS DOUBLE WIDTH RADIAL

Interchangeable with standard double-width bearings made to S.A.E. dimensions.

Yes Sir, smart production and maintenance men are paying a lot of attention to the Angles these days—especially when it comes to anti-friction bearings. They know you can't expect precision bearings to carry complex loads at high speeds hour after hour, for day on end, without frequent down-time for servicing and replacements. That's why they're demanding the higher service factors provided by Rollway's *right-angled* loading of solid cylindrical roller bearings.

Rollway splits every load into its two simplest components of *pure radial* and *pure thrust*. All oblique and compound loading is eliminated. Sliding friction is reduced to the vanishing point. And a more compact bearing assembly with more massive rollers of uniform cross section is the result. You'll notice improvement in bearing life, speed of operation and amount of down-time and service attention almost immediately.

Free Engineering Analysis and Bearing Recommendations

Let Rollway's bearing specialists examine your plans, especially your conversions, and tell you the right type and series for each bearing. There's no charge for this service. Most applications require only American standard metric dimensions and tolerances. REMEMBER, you can usually change over from other bearings to ROLLWAY'S of higher load capacities without increasing boundary dimensions.

ROLLWAY BEARING COMPANY, INC., SYRACUSE, N. Y.

BUILDING HEAVY-DUTY BEARINGS SINCE 1908 — BEARINGS

BRIQUETTING MAKES FOUNDRY SCRAP

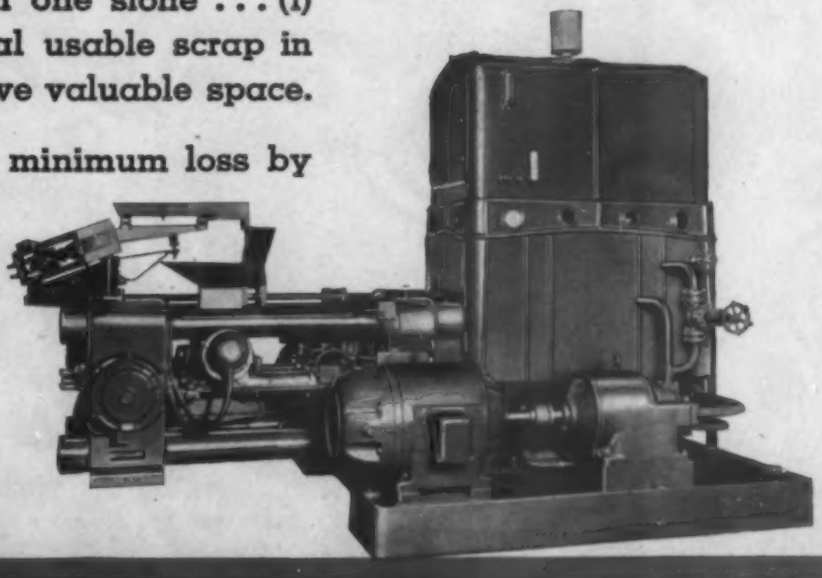
Illustration shows relative size of 5 lbs. of borings and turnings — before crushing and after briquetting.

Convert THIS into THAT

Today — scrap metal is vitally needed and space is at a premium. A Milwaukee Hydraulic Briquetting Press enables you to "kill *both* birds with one stone"... (1) convert bulky turnings into an ideal usable scrap in the form of briquettes and (2) conserve valuable space.

Scarce metals are reclaimed with minimum loss by means of briquetting. Closer metal control results because of known analysis of briquettes. Save metal and dollars. Be independent of the scrap market. Install a Milwaukee Briquetting Press. 5 sizes available. . . Write for literature.

Large Milwaukee Hydraulic Briquetting Press with a capacity of over 3 tons of briquettes per hour. Four other sizes available.



MILWAUKEE FOUNDRY EQUIPMENT CO.

1238 WEST PIERCE STREET • MILWAUKEE, WISCONSIN, U. S. A.

BEHIND THE LINES!

BROSIUS GOGGLE VALVES

Brosius Goggle Valves are built with a double drive, the opening and closing of the valve seats and the swinging of the plate being operated independently.

The swinging of the plate can be arranged for operation by hand or a motor driven drive can be provided.

Brosius Valves are self contained and independent of the gas lines.

All operating mechanism is placed outside the valve.

There is no obstruction to the flow of gas.

A minimum amount of gas is lost during operation.

BROSIUS CHARGING MACHINES AND MANIPULATORS

The 6000 pound Brosius Auto Floor Manipulator shown is one of many of these machines now being used in the production of war materials. They are designed to manipulate forging blanks under hammers and presses as well as charge and draw the heating furnaces.

All machines are driven by an electric motor, receiving their current from the main plant supply line through a rotating collector as used on the machine shown, or from a gasoline driven generator mounted on the machine.

These machines are also arranged with tongs for serving mills, heating furnaces, presses, hammers, etc., or designed to handle a standard charging box for serving melting furnaces.

Brosius Auto Floor Machines are built in capacities of from 2000 to 20,000 pounds, giving a wide range of designs to meet most any requirement.

BROSIUS CLAY GUNS

The Brosius Clay Gun Equipment is either Column (as shown) or Pedestal Mounted. On both types of mountings the gun is swung into and out of the tapping hole by means of an individual motor. The worm and spur gear drive is positive and the gun travels into and out of the tapping hole at a uniform speed.

The gun proper is of the same design for both types of mountings and the clay piston is driven by an individual motor through a rack, pinions, and a worm gear reduction.

V ... — *Edgar E.* **BROSIUS** *Company* V ... —

MANUFACTURERS AND DESIGNERS OF SPECIAL EQUIPMENT FOR BLAST FURNACES AND STEEL MILLS

PITTSBURGH, SHARPSBURG BRANCH, PA.

Brosius Equipment is covered by patents allowed and pending in the United States and Foreign Countries

EVERY MINUTE COUNTS

Fleeting minutes make hours. And every hour lost means delay in the Victory which America is determined to win. Every minute counts . . . in the movement of ore and steel . . . the handling of war material and supplies.

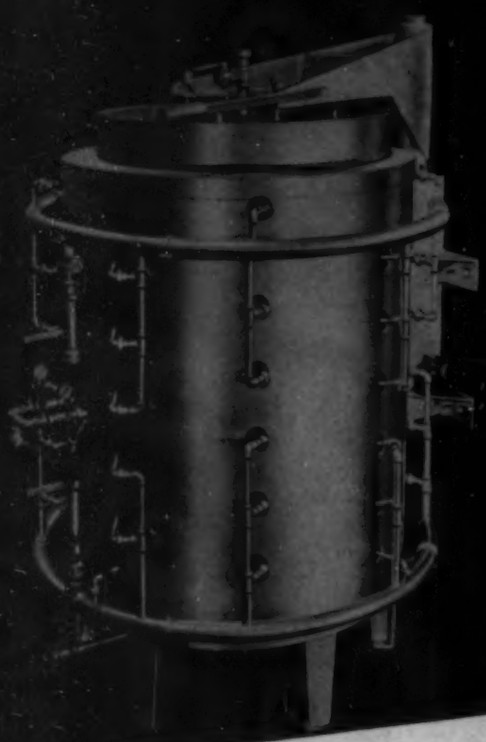
Many of America's steel mills realized the value of minutes long before Pearl Harbor. Today Plymouth Flexomotives are operating in those plants with the highest degree of efficiency, with praise from all department heads who are responsible for keeping the loads moving.

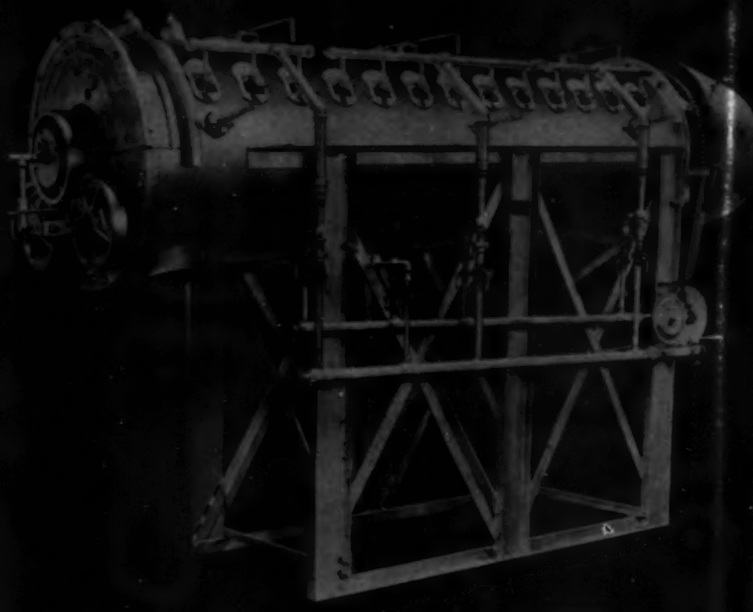
If you want more tonnage moved in less hours . . . dependable and economical performance 24-hours a day . . . you will demand a *PLYMOUTH FLEXOMOTIVE.*

PLYMOUTH LOCOMOTIVE WORKS • Division of The Fate-Root-Heath Co., Plymouth, Ohio

PLYMOUTH *Flexomotive*

DOLLAR FOR DOLLAR——————THE GREATEST LOCOMOTIVE EVER BUILT



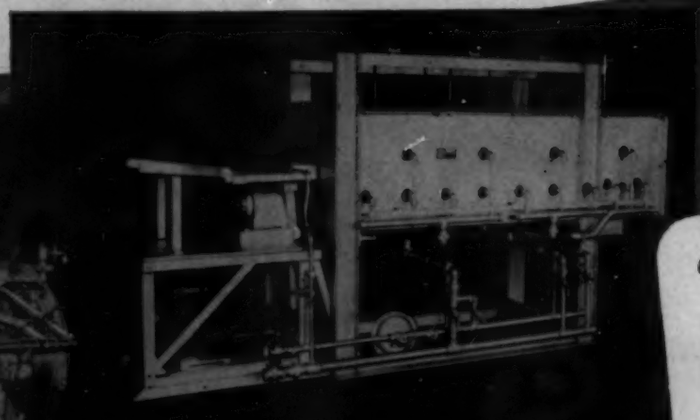


The "A. G. F." way is the modern way to heat treat

"A.G.F." experience covering more than half a century is ready to help you meet and solve any heat treating problems which are involved in war production.

"A.G.F." engineers are competent to advise you on your needs because they have pioneered many of the developments in industrial heating. The first air blast melter, the first rotary retort machine, the first to originate the gas carburizing process as well as the nitrogenizing (nitriding) process with equipment for its use—"American" engineers have always led the way.

"A.G.F." Heat Treating equipment is modern, operates on a minimum of fuel, produces uniformly satisfactory work, is easily controlled and is available for practically all heat treating purposes.



Continuous Clean Hardening Machine (No. 166 S-C Reciprocating Pull Muffle). Developed to assure clean, hard work free from scale. A full muffle is provided through which work travels. Any desired temperature may be carried as well as any desired heating time.

Rotary Gas Carburizer (No. 2827). Rotation insures uniform results through mixing of work; tilting feature facilitates charging and discharging. Low in operating cost; handles a wide variety of work. Can be used also for clean hardening, annealing, normalizing, etc.

"A. G. F." OFFERS

- Forges
- Oven Furnaces
- High Speed Furnaces
- Pot Furnaces
- Melters
- Reciprocating Heating Machines
- Rotary Heating Machines
- Conveyor Heating Machines
- Open Flame Heating Machines
- Rotary Tempering Machines
- Special Heating Machines
- Gas Carburizers
- Tube Furnaces
- Cylindrical Furnaces

If your problem involves getting more and better work in shorter time—consult "A.G.F." Write, giving details, so that we can make a proper recommendation.

AMERICAN GAS FURNACE CO.

Elizabeth, New Jersey

AMERICAN GAS FURNACE CO. PIONEERS 1878

Get in the SCRAP for VICTORY . . . BALE it the G-H Way!

This installation shows a Model MCY Baler, one of several G-H Hydraulic Balers operating in various Westinghouse plants.

In a leading body plant now devoted to War Production, a conveyor system carries baled metal scrap from the G-H Baler direct to freight cars.

The handling and baling of metal scrap varies in every metal working plant, depends upon the type and volume of scrap produced and the ease with which it may be routed to the baler. The capacity of the baler must be equal to peak requirements. Its power and efficiency must result in bales of maximum density at lowest possible cost.

The efficiency, capacity and durability of G-H Hydraulic Balers, coupled with the vast experience of G-H engineers in setting up efficient scrap-baling installations in all types of plants, is your assurance of a profitable scrap salvage program.

For Experienced Counsel on Your Scrap Baling Problems, Write —

Representatives in Principal Cities

G-H

GALLAND-HENNING MFG. CO.

2747 SOUTH 31ST STREET • MILWAUKEE, WISCONSIN

A 3853-1PC-R

Industrial Engineers

All Types of Heating Equipment and Allied Mechanisms

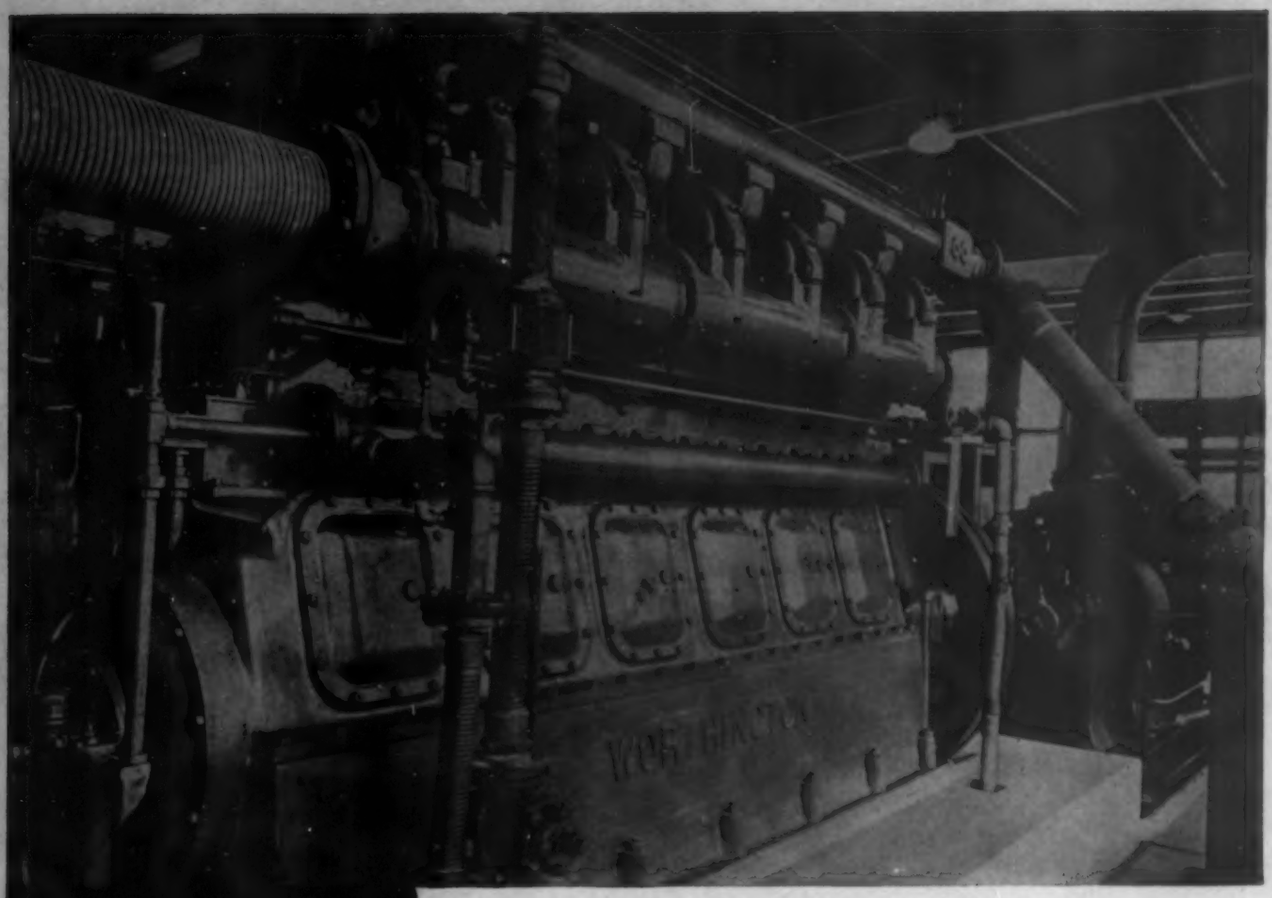
Aluminum Billet Heating Furnace

THE combined production from all Salem aluminum billet heating furnaces exceeds that of any other make. Broad experience and knowledge gained through the development of all this equipment won for Salem high recognition — especially since these Salem furnaces heat billets with the greatest uniformity at less cost and in the minimum of time.

The furnace, illustrated above, heats aluminum billets prior to rolling, using oil-fired convection units which bring the billets from room temperature to 1000° F. at a rate of 3600 pounds per hour. The billets, with diameters ranging from 6" to 10", vary in length from 12" to 28". The moving hearth consists of 6 strands of chains with special attachments for holding the round billets. Each two strands of chains constitutes a separate conveyor which has its own drive at each end of the furnace, thus permitting operators to reverse the travel. There's no guesswork when Salem's aluminum billet heating furnaces are being built, and hence production starts off immediately without days and weeks of delay for final adjustments. You get more production with less maintenance.

Consult Salem engineers now regarding your furnace problem, whether it's for ferrous or nonferrous metals.

SALEM ENGINEERING CO. . . . SALEM, OHIO



PENFLEX Metallic Hose

. . . Armored for Safety
. . . Flexible for Service

Uninterrupted Service and Safety are important factors in generating power for War Production. PENFLEX Metallic Hose with 4-wall interlocking joint construction and ⅜" "come and go" per lineal foot of length is designed for long life, trouble-free service on intake and exhaust lines, oil, water and other connections. It resists thermal and mechanical strains and fatigue . . . it absorbs vibration and provides safe, economical service.

PENFLEX-WELD corrugated, jointless Tubing gives leakproof service on fuel oil feed, circulating water, and starting air lines.

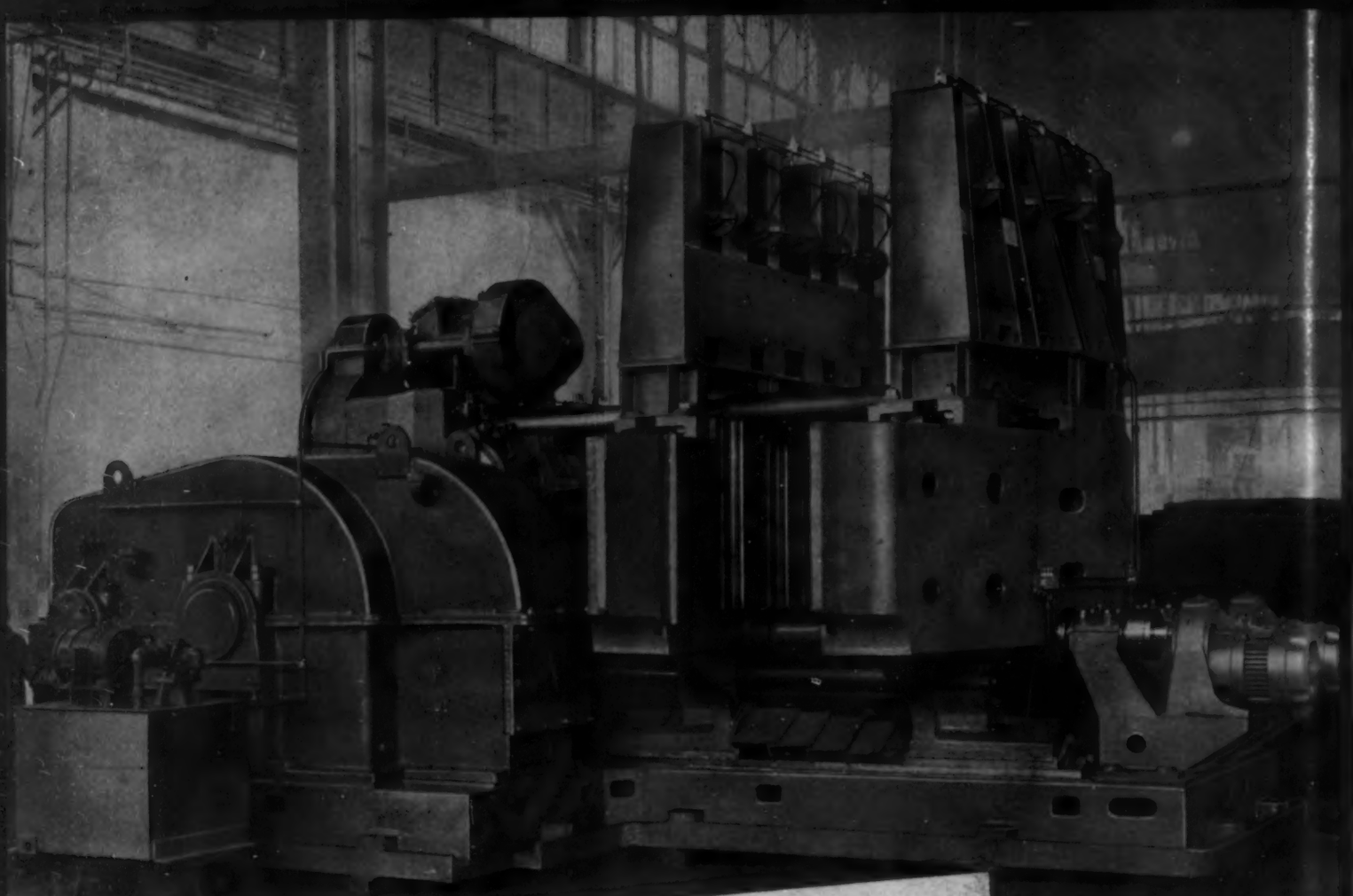
Full data in practical diagrammatic form in Bulletin 71.

In sizes 1" to 18" I. D.

PENNSYLVANIA FLEXIBLE METALLIC TUBING CO.

7219 Powers Lane, Philadelphia, Pa.

MAKERS OF FLEXIBLE METAL PIPE SINCE 1902



MORGAN GAG PRESS FOR STRAIGHTENING HEAVY ROLLED SECTIONS

● Among the many types of mill equipment built by Morgan, is the heavy duty gag press or straightener illustrated above. It is of massive construction with drive gears and flywheel mounted on roller bearings and all enclosed in an oil-tight welded housing. All anvil blocks are raised and lowered by individual air cylinders. The two feed rollers are driven by individual motors. This press is typical of the many types of Morgan mill equipment.

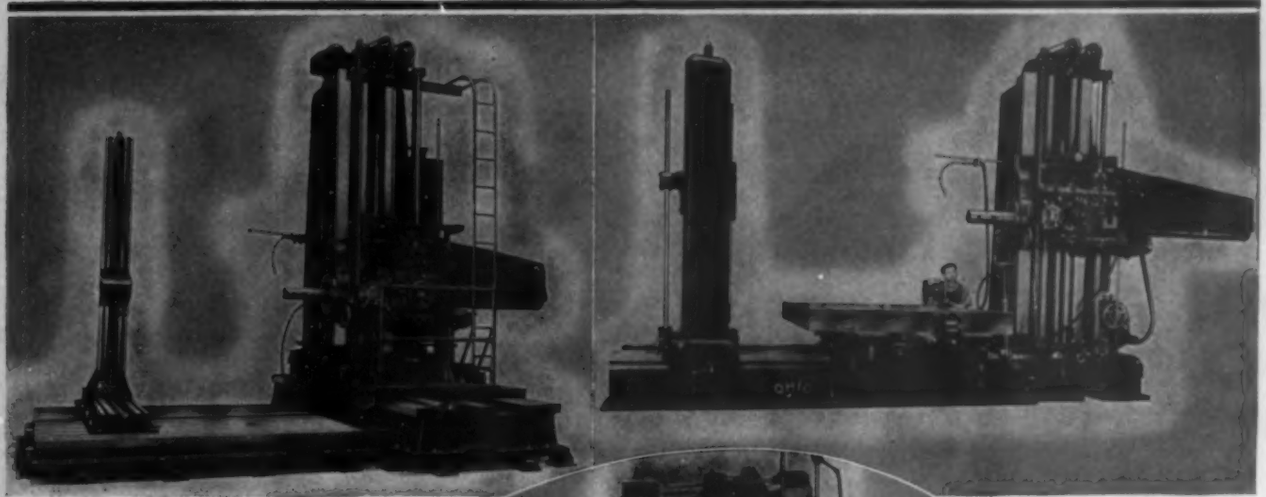
BUILT BY MORGAN Engineering

THE MORGAN ENGINEERING CO.

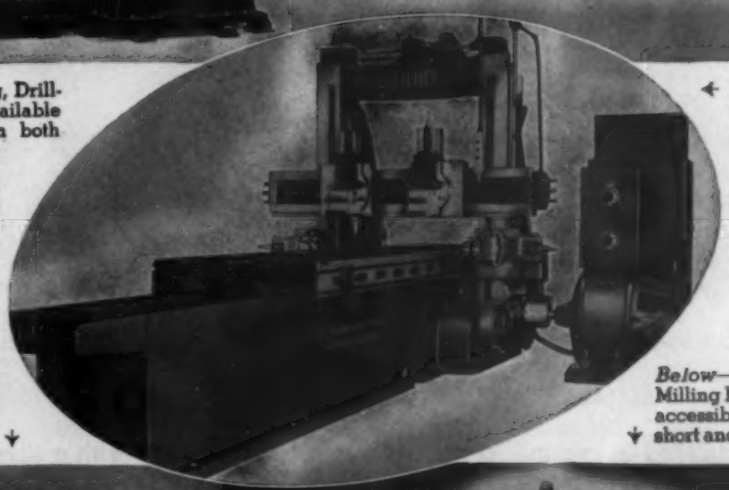
ALLIANCE, OHIO. 1420 Oliver Building, Pittsburgh

DESIGNERS • MANUFACTURERS • CONTRACTORS • BLOOMING MILLS • PLATE MILLS STRUCTURAL MILLS • ELECTRIC TRAVELING CRANES • CHARGING MACHINES • INGOT STRIPPING MACHINES • SOAKING PIT CRANES • ELECTRIC WELDED FABRICATION • LADLE CRANES • STEAM HAMMERS • STEAM HYDRAULIC FORGING PRESSES • SPECIAL MACHINERY FOR STEEL MILLS

Ohio Machine Tools and Revolving Tables Are Rapid, Proven Aids to War Production



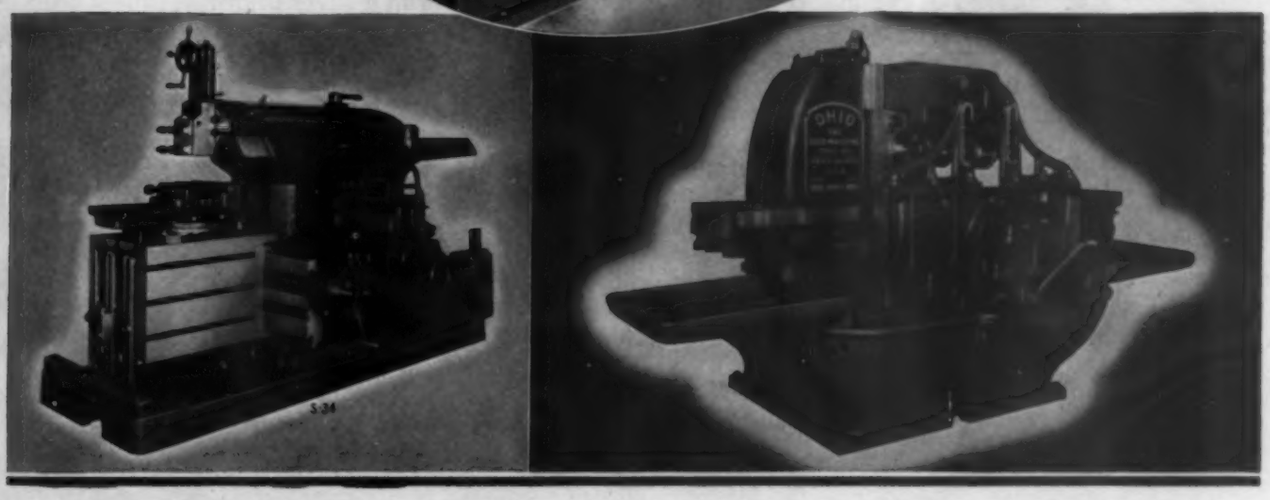
Above—Ohio Horizontal Boring, Drilling and Milling Machines are available in 5" and 6" spindle sizes in both table and floor types. *Left*—extra heavy duty FLOOR type. *Right* — extra heavy duty TABLE type. *Bulletins 300 and 310*

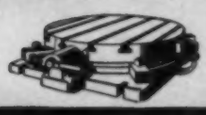


← *Left* — Ohio Planers, double housing type, standard and heavy duty models, are furnished in sizes 24" x 24" through 48" x 42" in five types of drives. *Bulletin 500*

Below — Ohio Dreadnaught Shapers are built in 16" to 36" sizes, with a complete range of specifications. *Bulletin 59* ↓

Below—The Ohio Production Milling Machine, convenient and accessible, is profitable on both ↓ short and long runs. *Bulletin 400*





Ohio *round* revolving tables are built in sizes from 24" through 96"; *square* revolving tables from 36" x 36" through 72" x 72" size; also universal unit 40" x 51". Important features fit them for fast, modern production. *Bulletin 375.* THE OHIO MACHINE TOOL COMPANY, KENTON, OHIO.

OHIO DREADNAUGHT

HORIZONTAL BORING, DRILLING AND MILLING MACHINES · SHAPERS · PLANERS

Announcing a New Name

in the Steel Tube Industry

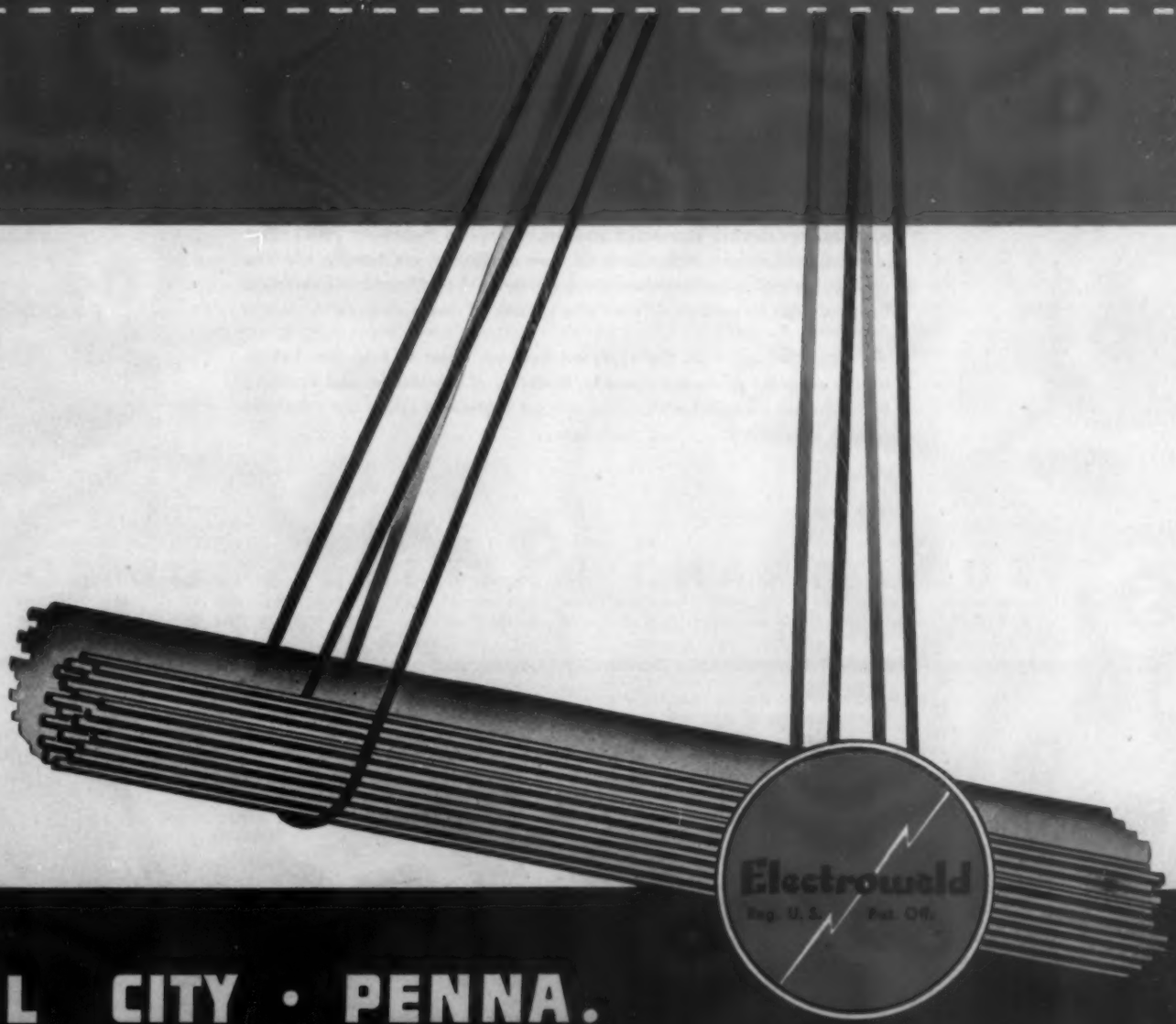
You will want to remember the name ELECTROWELD. It is stenciled on every length of the world's most modern steel tubing.

The Electroweld Steel Corporation recently completed America's most up-to-date, continuous, electric resistance welded tube mill for the production of pressure tubing and mechanical tubing. The refinements incorporated in this mill provide an improved product with a silver-bright surface. Precision control over the entire production operation lends uniformity of structure in the weld area, and thus ELECTROWELD Steel Tubing has a homogeneous structure throughout. This new mill not only forms tubing more accurately to size than commercial tolerance requirements, but it also permits greater uniformity of wall thickness, weight, and ductility. Furthermore, no other steel tubing is cut off so smoothly.

Electroweld Tubing goes to war in an amazing quantity. Another mill, now being built, will increase Electroweld production. When victory be ours, we trust that our type of products will fit into your peacetime operations.

Electroweld STEEL CORPORATION

Electroweld
STEEL CORPORATION



OIL CITY · PENNA.

SUNDSTRAND

ENGINEERED PRODUCTION CONSERVES MAN-POWER

AUTOMATIC LATHES
Models 8-10-12

HYDRAULIC RIGIDMILS
No. 00-0-1

NO. 2 ELECTROMIL

Sundstrand Engineered Production Service places at your disposal years of experience, ability, and data acquired in making the most effective applications of our Automatic Lathes, Rigidmils, and other Sundstrand machine tools. It conserves your man-power by making best use of machine horsepower and automatic cycles . . . gives you maximum production at minimum cost and operator effort. Fast, accurate, labor saving, Sundstrand machine tools are built in standard semi-standard, and special types and sizes that handle a very large variety of the work-pieces you are being called upon to produce at top speed.

Automatic . . . Sundstrand machine tools are automatic after starting; motor power relieves man-power, operators work more easily, run additional machines without special effort.

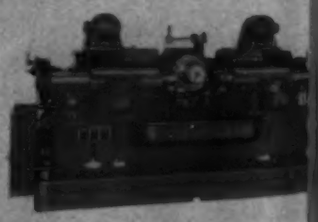
Productive . . . Sundstrand machine tools work modern cutting materials to full capacity in high-speed cycles having hydraulic, electrical, and mechanical actuation in various combinations. Speed is accompanied by ample power, strength, and rigidity for all work in the capacity of each machine.

Adaptable . . . Easy set-up, quick change-over, and extremely simple operation are notable Sundstrand qualities. Standard Automatic Stub Lathes and Rigidmils set new high records on mass production, are equally effective on short-run work. Semi-standard and specially equipped Sundstrand machines frequently can be used on different jobs by making simple changes.

At your Service . . . Our representatives are eager to help you benefit by the enormous productive capacity, flexibility of application, and economy in Sundstrand machine tools . . . they will get Engineered Production proposals for you promptly. . . . *Consult them, today.*

FLUID-SCREW RIGIDMIL
Simplex

FLUID-SCREW RIGIDMIL
Duplex



SPECIAL MACHINES

MILLING AND CENTERING MACHINES

GET FREE BOOKLET

Booklet shown at right contains condensed descriptions of all Sundstrand products and services. Write today for your copy. Ask for Bulletin 708.

VERTICAL PROFILE RIGIDMILS
Rotary-Horizontal

SUNDSTRAND MACHINE TOOL CO.

2531 ELEVENTH STREET • ROCKFORD, ILLINOIS, U. S. A.

by saving tons of critical materials and by releasing strategic machines

When you were making cars, stoves and refrigerators, Prestole Fastening Methods *saved you money*. Now that you are making guns, tanks and planes, Prestole Fasteners also save you *money* plus *time*, *material* and *vital machines*.

The Prestole Organization is now helping to redesign vital components to relieve bar stock bottlenecks and screw machine shortages. Here are presented typical examples of Prestole fasteners and redesigned components being produced by the millions:

Prestole Nut Clip No. 196-13

It's doing its job on heavy mobile equipment. Does job of a nut and lock washer. Snaps into position, holds securely.

Prestole Cable Clip No. 170-4

Saves separate nut plus time in assembly. Much in demand in peacetime, now doing its war job on many fronts for America.

Prestole Coil Locking Nut No. 131-3

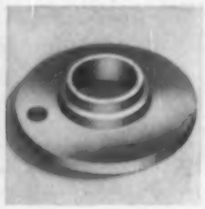
Used as an adjusting nut on Uncle Sam's radio sets. No bigger than a minute, yet saves many precious machine hours.

Firing Pin Assembly

Formerly machined from aluminum bar stock. Prestole stamps it out of steel strip. Pin is staked to stamping. A time and material saver!

Bomb Fin Crate Clip

Replaced a special wing bolt and nut; saved eight carloads of steel and thousands of vital man and machine hours.



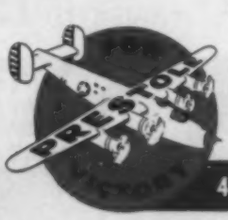
Stationary Gear Carrier

Close tolerances seemed to require screw machines, but Prestole makes them on punch presses, thus speeding production!

In aircraft, Prestite Sheet Holders are preferred because they're *safe* and *wear* longer.

★

The Prestite "Safety Champ" Gun was designed to safeguard the worker.



Prestole DIVISION

[DETROIT HARVESTER CO.]

4500 DETROIT AVE., TOLEDO, OHIO

Use KENNAMETAL* *To cut High Brinell Steels*

STYLE 11

By using KENNAMETAL tools for machining High Brinell steels it is not first necessary to reduce the hardness of the work piece, complete the machining, then reharden the job for the finished product; KENNAMETAL will cut right through steels up to 550 Brinell.

KENNAMETAL is a fine-grained carbide cutting tool that will not gall or crater from hot chips consequent to machining hardened metals. High Brinell steels demand a hard cutting material; KENNAMETAL has a Rockwell C hardness of 77.6, Rockwell A 90.8 and has a transverse rupture strength of 305,000 lbs./sq. inch.

KENNAMETAL CUTS 1¼ MILES OF HARDENED STEEL IN 80 MINUTES

The illustration shows a Style 11 KENNAMETAL tool machining high carbon steel (401-427 Brinell) at a speed of 80 feet/min. at a feed of .032"; depth of cut 0 to 1". The tool cut 1¼ miles of this hardened metal before regrinding was necessary.

KENNAMETAL not only cuts hardened steels which ordinary carbides cannot machine—it consistently increases production on steels of any hardness. Use it for all your steel boring, turning, and facing operations; there is a tool for your particular application.

Write for your copy of the new KENNAMETAL Catalog, No. 43.

*INVENTED AND MANUFACTURED IN U. S. A.

KENNAMETAL THE All America CARBIDE

McKENNA METALS Co.

200 LLOYD AVE., LATROBE, PENN

Foreign Sales: U. S. STEEL EXPORT CO., 30 Church St., New York (Exclusive of Canada and Great Britain)

IT'S DOUBLY IMPORTANT NOW—

EXTEND THE LIFE OF YOUR FEEDING FINGERS AND COLLETS

Follow these suggestions to help feeding fingers and collets give longer and better service at a time when unusual demands are causing long delays for replacements:

Use only **CLEAN BARS** of stock. Dirty bars should be wiped clean before using. This is a major step toward longer life for collets and fingers.

AVOID BREAKAGE and work spoilage by keeping collets and the seats on which the collets rest, free from chips and dirt.

DO NOT DRIVE BARS into feeding fingers. See that all bars have a little chamfer on the end to aid them in entering the feeding fingers readily.

MAKE SURE the collet and finger are the **correct** size for the stock — otherwise breakage may occur.

USE FEEDING FINGER ADAPTERS to utilize the same finger in machines of different sizes — reduce the number of different fingers required for each size of stock.

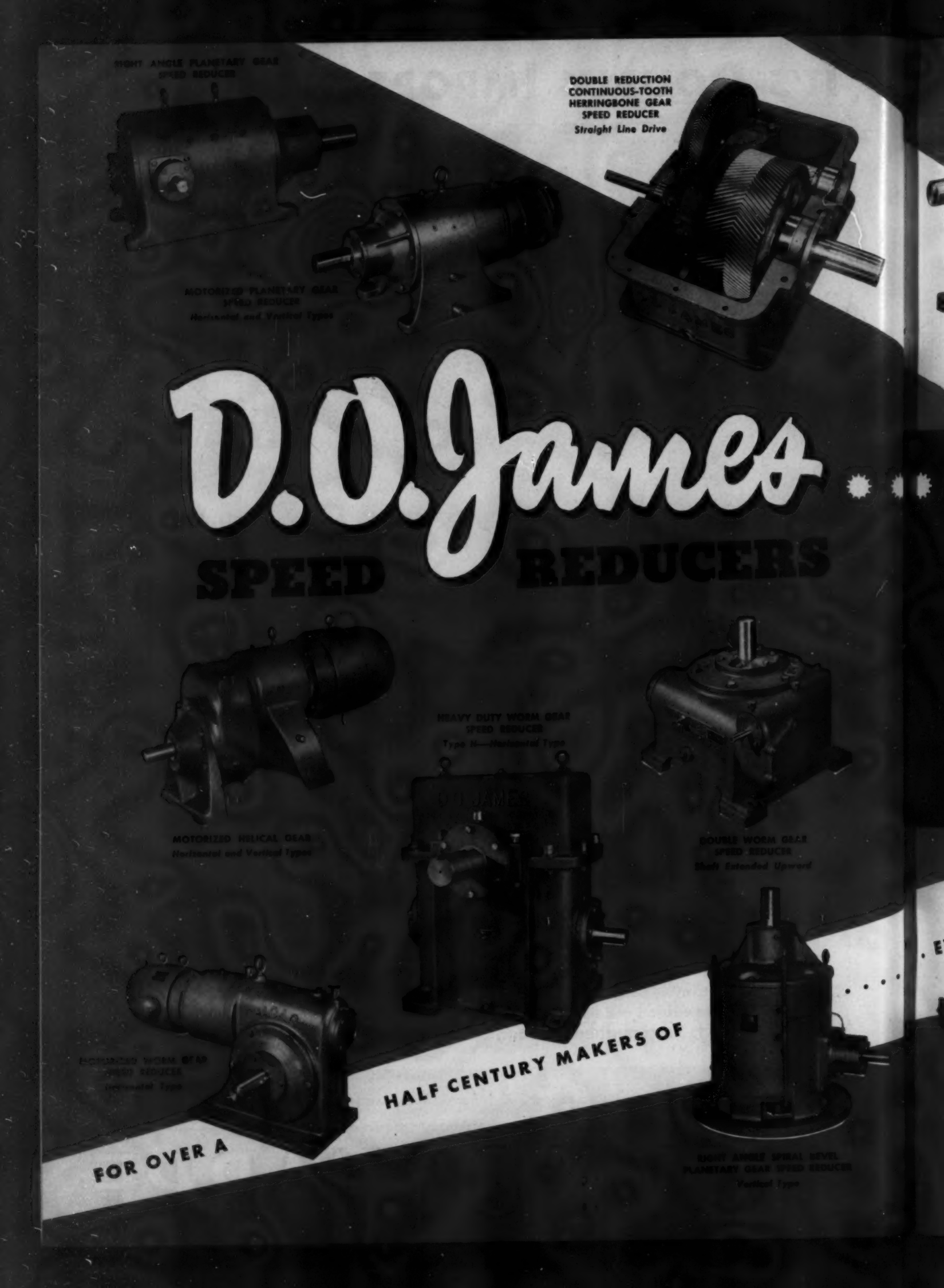
IMMEDIATELY after removing a feeding finger or collet, clean it and place it in the proper storage compartment where it can be found easily for its next job — or by another operator.

These small details are important to keep your production high and to avoid delays that may occur due to the difficulty in obtaining new collets and fingers. It's **another** way in which you can help to **keep machines producing** for the united war effort.

We are proud to be honored with the Navy "E", awarded for outstanding accomplishment in Defense production.
Brown & Sharpe Mfg. Co.
Providence, R. I., U. S. A.
BS

Reproductions of this advertisement for use on your bulletin board furnished on request.

BROWN & SHARPE


RIGHT ANGLE PLANETARY GEAR SPEED REDUCER
DOUBLE REDUCTION CONTINUOUS-TOOTH HERRINGBONE GEAR SPEED REDUCER
Straight Line Drive
MOTORIZED PLANETARY GEAR SPEED REDUCER
Horizontal and Vertical Types
D.O.James
SPEED REDUCERS
HEAVY DUTY WORM GEAR SPEED REDUCER
Type H—Horizontal Type
MOTORIZED HELICAL GEAR
Horizontal and Vertical Types
DOUBLE WORM GEAR SPEED REDUCER
Shaft Extended Upward
MOTORIZED WORM GEAR SPEED REDUCER
Horizontal Type
FOR OVER A HALF CENTURY MAKERS OF
RIGHT ANGLE SPIRAL BEVEL PLANETARY GEAR SPEED REDUCER
Vertical Type

DOUBLE WORM GEAR
SPEED REDUCER
Horizontal Type

HELICAL WORM GEAR
SPEED REDUCER
Vertical Type

THEY JUST KEEP ROLLIN' ALONG

Established 1888

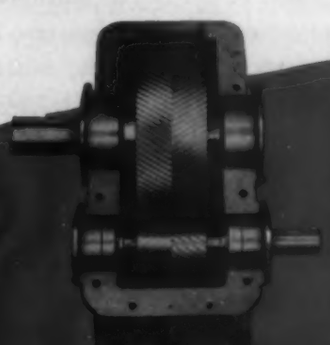
The precision-in-built quality and design of the D. O. James Speed Reducers gives them a formidable achievement record that has definitely proven the statement that they are "built to take it." Now, more than ever, this is an imperative quality—and will vitally aid in the maintenance of American Industry's War-Time Production Schedules—*"That Must Be Kept Rollin' Along!"*

D. O. JAMES MANUFACTURING COMPANY
1140 W. MONROE STREET • CHICAGO, U. S. A.

HELICAL WORM GEAR
SPEED REDUCER
Horizontal Type

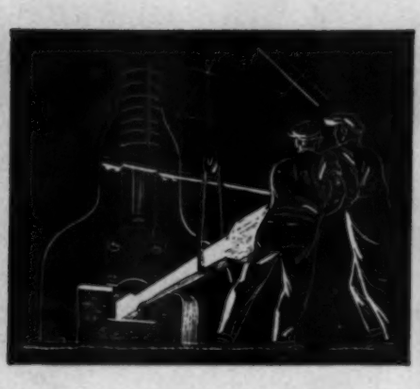
EVERY TYPE OF GEAR AND GEAR REDUCER

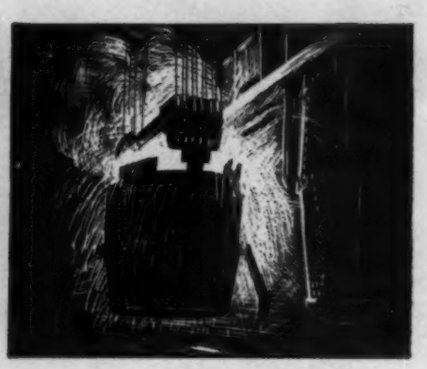
MOTORIZED WORM GEAR
SPEED REDUCER
Vertical Type



CONTINUOUS-TOOTH
HERRINGBONE GEAR
SPEED REDUCER
Single Reduction

Resolved—

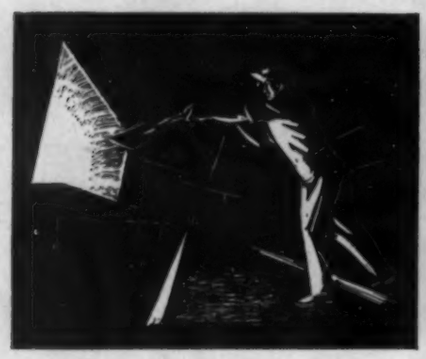


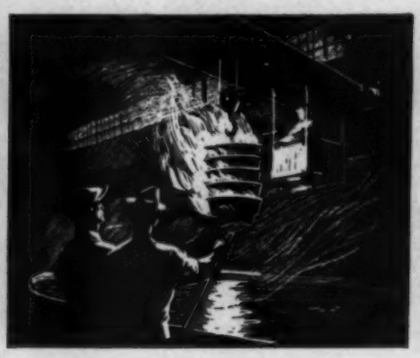


that, to 147 years of Standard history shall be added another year of service to America, to its railroads, and its industries.

that, the skill and long experience of Standard personnel shall be constantly applied in the production of every Standard product.

that, from acid open hearth to finished forging, Standard process control shall protect Standard quality at all times.





that, the constant supervision of materials by Standard's trained metallurgists shall continue to safeguard customer's interests.

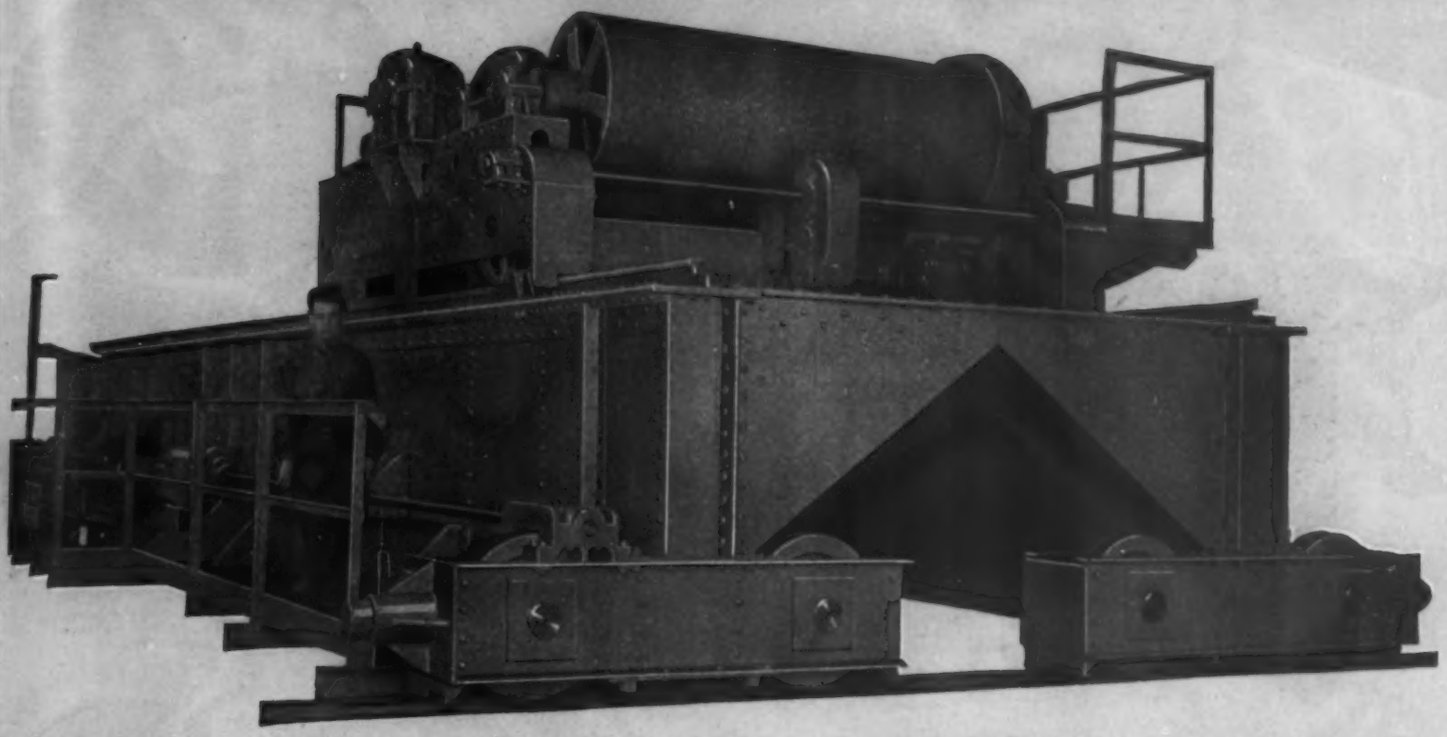
that, the reputation for dependability and long service enjoyed by Standard products through the years be increasingly deserved.

that, the high production for war which merited Standard workers the Army-Navy E and subsequent added stars shall be steadily maintained.

that, above all, the energy and resources of all of us at Standard shall be devoted unselfishly in support of the more than two hundred Standard employees now in our country's armed forces, and toward hastening the day of homecoming for them and all of America's sons.

STANDARD
STEEL WORKS
DIVISION OF THE BALDWIN LOCOMOTIVE WORKS
PHILADELPHIA

for MAXIMUM SERVICE



with MINIMUM ATTENTION

UCLID HOISTS

available with all types of trol-
s and controls in sizes from ¼ ton
20 tons capacity.

Euclid

CRANES *and* **HOISTS**

TO keep production machinery running—for the duration—is the concern of many executives today.

The ease and speed with which Euclid cranes and hoists can be inspected, adjusted and serviced is noteworthy. Noteworthy also is their low maintenance cost.

EUCLID DESIGN provides simplicity, sturdiness and accessibility. It incorporates conventional features of general acceptance by all builders of high grade cranes plus exclusive improvements which provide longer life, ease of maintenance and trouble free operation.

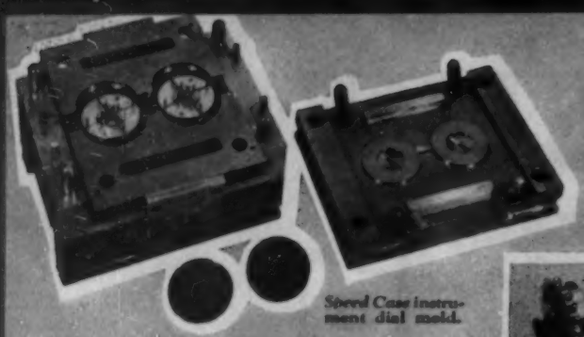
EUCLID CONSTRUCTION is thorough and honest in the structural work, machining and fitting of parts and wiring. Euclid cranes and hoists have heavier wiring and this wiring is more carefully applied and guarded than on other cranes and hoists. This means lower electrical maintenance expense and greater freedom from electrical difficulties.

CONSISTENTLY SATISFACTORY PERFORMANCE is indicated by the roll call of purchasers which includes many leading manufacturers. All are discriminating buyers. Many have re-ordered several times. An impressive number have standardized on Euclid equipment.

Write for catalogs and get a Euclid proposal covering your next requirements.

THE EUCLID CRANE & HOIST CO.

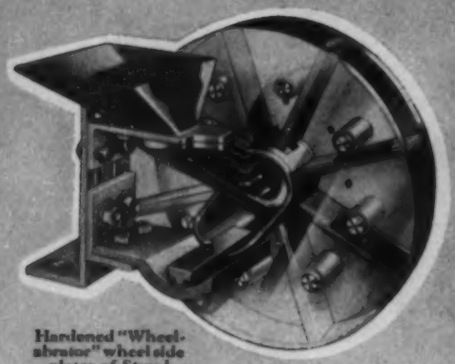
EUCLID, OHIO, *Suburb of Cleveland*



Speed Case instrument dial mold.

Speed Treat cartridge case "cupping" die.

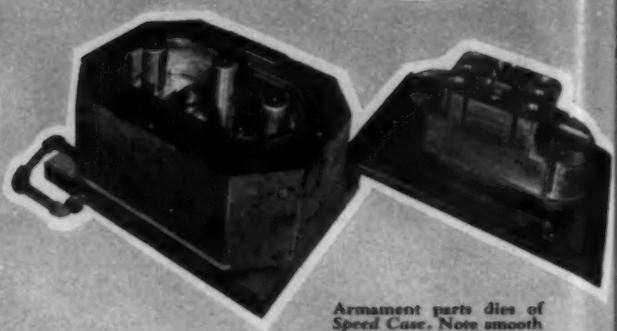
Cloverleaf die of *Speed Case*.



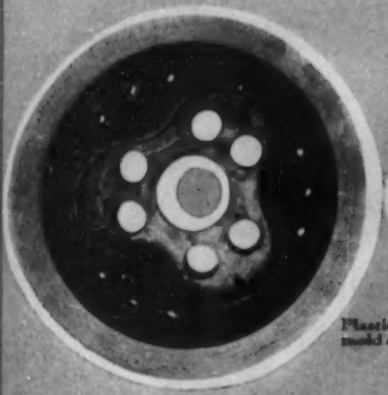
Hardened "Wheelabrator" wheel side plates of *Speed Case*.

Speed Treat and *Speed Case* sprocket wheels.

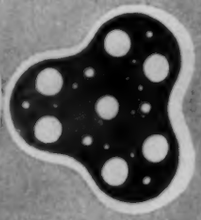
A generator coupling disc for a diesel locomotive of *Speed Treat* Steel.

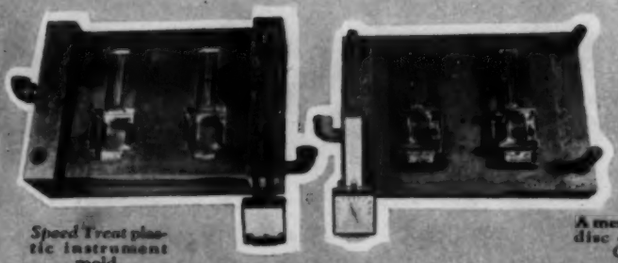


Armament parts dies of *Speed Case*. Note smooth finish results of free machinability.

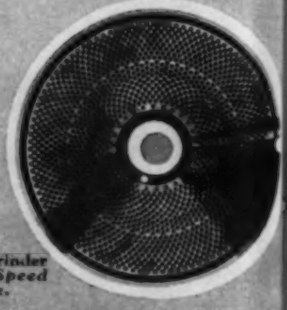


Plastic compression mold of *Speed Treat*.





Speed Treat plastic instrument mold.



A meat grinder disc of *Speed Case*.

SPEED TREAT STEEL

.40 to .50 Carbon Hot Rolled Plate

These two steels—*Speed Treat* and *Speed Case*—are saving time *now* when it counts the most. Check these advantages:

- ✓ **Cut machining time up to 33%. Greatly increase tool life.**
- ✓ **Quickly respond to heat treating—with minimum warpage.**
- ✓ **Available in standard gage hot rolled plates—flame cut to close tolerance—minimum waste—no short ends.**

Speed Treat is neither an alloy nor a tool steel—it is an open hearth .40 to .50 carbon steel. Case studies covering *Speed Treat* dies, die shoes, jigs, fixtures, gears, sprockets and fabricated machine tool parts show greatly upped production and a better-than-average service life.

Speed Case is an open hearth low carbon steel. It provides the fastest machining steel plate available. Due to its cleanliness, it is especially adapted to the manufacture of mechanical rubber and plastic molds.

Both steels are available in standard gage hot rolled plates and hot rolled and cold finished bars. Our engineers are prepared to tell you promptly whether these steels can replace those you have been accustomed to using. Bulletin 942 gives further details.

W. J. HOLLIDAY & CO.
Established 1856
Hammond, Ind. Chicago, Ill.
Indianapolis, Ind.

Distributed by

BEALS, McCARTHY & ROGERS
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PECKOVER'S, LTD.
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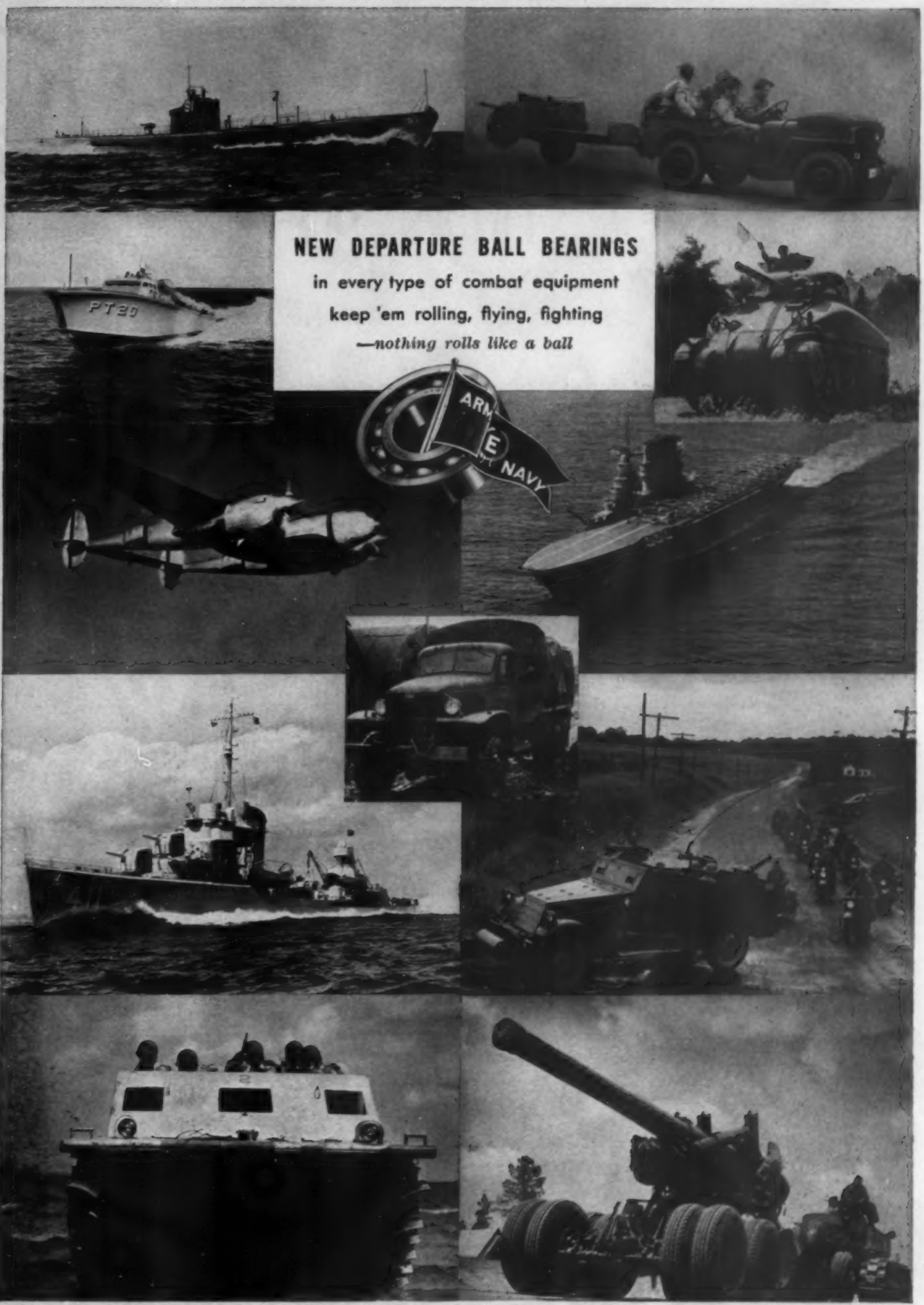
SPEED CASE STEEL

Low Carbon Hot Rolled Plate



NEW DEPARTURE • DIVISION OF GENERAL MOTORS • BRISTOL, CONNECTICUT

OFFICIAL U. S. ARMY & NAVY PHOTOS

HARPER STOCKS the
UNUSUAL AND MAKES
the "Super Unusual"
BRASS
BRONZE
COPPER
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STAINLESS
Think of 4320 stock items of fastenings . . . including almost every conceivable type of bolt, nut, screw, washer and rivet in the non-ferrous and stainless alloys. Such a stock is one of Harper's contributions to a nation at war.
If the fastening you want isn't in this stock, Harper can make it promptly (priorities permitting) on extensive, modern, high speed machinery . . . from stocks of metals in basic forms. Submit your specifications.
WRITE FOR CATALOG
. . . and reference book. 80 pages—4 colors — 193 illustrations — numerous tables and other data. Free when requested on a company letterhead.
The H. M. HARPER COMPANY
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EVERLASTING FASTENINGS
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Awarded Dec. 7, 1942

Pan American Airways Rely On -

BROWN PRECISION CONTROL

Brown Control Potentiometer Installed on Electric Furnace for Heat Treating Metal Parts in the Pan American Airway Clippers.

PAN AMERICAN AIRWAYS is rendering an invaluable service to the United Nations confronted with the problems of commercial transportation during war times.

This service is made possible through scientific progress and the use of modern developments to produce and maintain equipment operating at maximum efficiency.

On their electric furnaces Pan American relies on Brown Potentiometer Controllers to maintain the precise temperature for perfect heat treatment of parts used in their Clippers —parts that must stand the terrific strain of high speed, vibration and force of the elements.

In thousands of other plants manufacturing aeroplanes, guns, tanks, munitions, etc., you will find Brown Potentiometers on duty, measuring and controlling the temperatures of important processes — guarding against spoilage — improving quality — stepping up production of war materials. These are essentially the road to Victory and we are proud of the important role Brown Instruments are playing in the nation-wide drive for maximum production and output.

BROWN POTENTIOMETER CONTROLLERS

THE BROWN INSTRUMENT COMPANY, 4462 WAYNE AVENUE, PHILADELPHIA, PENNSYLVANIA

DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR CO.

MINNEAPOLIS, MINNESOTA, AND 119 PETER STREET, TORONTO, CANADA

[Wadsworth Road, Perivale, Middlesex, England

Nybrokajen 7, Stockholm, Sweden

TO MEASURE AND CONTROL IS TO ECONOMIZE

OVERCOME THE SHORTAGE OF TIN BASE BABBITTS . . .

up to 100 times LONGER BEARING WEAR

with

Westinghouse MICARTA Roll Neck Bearings

Even *before* the WPB Order M-43-A cut the tin content of tin base babbitt to 12 per cent or less, Westinghouse Micarta outperformed ordinary bearings by as much as 100 to 1. Mill after mill has reported that Micarta stays on the job longer, rolls more tonnage with fewer shutdowns for replacements.

Micarta is the unusual bearing material developed by Westinghouse which combines resistance to pressure or pounding with an extremely low coefficient of friction. Its smooth, tough surface is self-polishing . . . and water-lubricated. Grease costs are eliminated. And Micarta's lower coefficient of friction is quickly reflected in substantial power savings. Runs with Micarta Roll Neck Bearings average about 200,000 tons!

On the basis of extensive experience in rolling mill applications, Westinghouse has engineered three grades of Micarta:

GRADE 271 (mineral-filled, fabric base)—A long-life bearing for high-speed, high-pressure work such as finishing stands.

GRADE 295 (graphite-filled, fabric base)—Designed for slow-speed applications such as roughing stands, blooming, slabbing and structural mills.

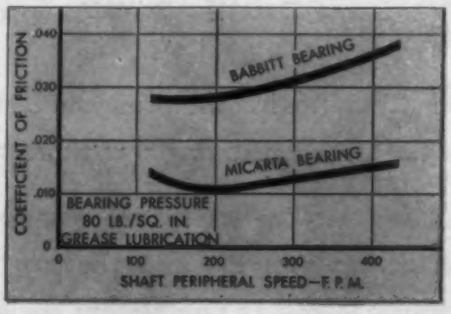
GRADE 280 (heavy fabric base)—A bearing for broad scope of general applications.

Ask your Westinghouse Representative to show you some of the production records set by other mills using Westinghouse Micarta. Or write today to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., Dept. 7-N.

J-06331

5 ways better . . . and available now!

1. **LOWER COEFFICIENT OF FRICTION**—The chart below shows comparison of Micarta with *pre-war* babbitt (85% tin).



2. **25 to 50% POWER SAVINGS**—Due to lower peak kw demand and average kwhr consumption.
3. **GREASE COST NEGLIGIBLE**—Micarta is water-lubricated, saves grease labor and cost.
4. **LONGER ROLL LIFE**—No scoring of roll necks, no electrolytic action.
5. **CLOSER TOLERANCES OBTAINABLE**—Holds gauge accurately, requires fewer screw-down adjustments.

Westinghouse

MICARTA

New MACHINE TOOLS
by CONSOLIDATED

DURING 1942 among other machines, Consolidated developed and shipped to our war industry plants the four new types of Machine Tools shown here — all special machines designed and built for specific jobs — but with a single purpose — to help win the war!

NEWTON COMBINATION ROTARY SAW AND PLANER

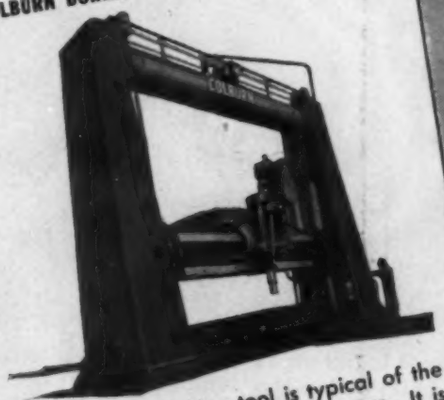
This huge machine tool is designed for planing and cutting armor plate and other tough metals used in the shipbuilding program.

It is the largest machine of this kind ever designed and is one of a number being built for the plants furnishing armor plate.

BETTS TANK MILLS
For Rapid Production of Parts For Tanks

In designing this machine there were two principal factors involved, first—a construction which would permit building the machines on a quantity basis thus permitting quick deliveries; and second—a construction insuring the utmost in productiveness of parts for tanks.

COLBURN BORING AND DRILLING MACHINE



This 150-ton machine tool is typical of the size required in the Victory program. It is a Universal Machine used for drilling and threading holes in heat-treated steel armor plate.

BETTS PIT TYPE PLANER

Simplified Machine Tools such as the machine shown above are of greater importance, now that it is clear that the price of victory is speed—and more speed—in the production of essentials for war and defense. The Pit Type Planer is a simplified form of the double housing planer.

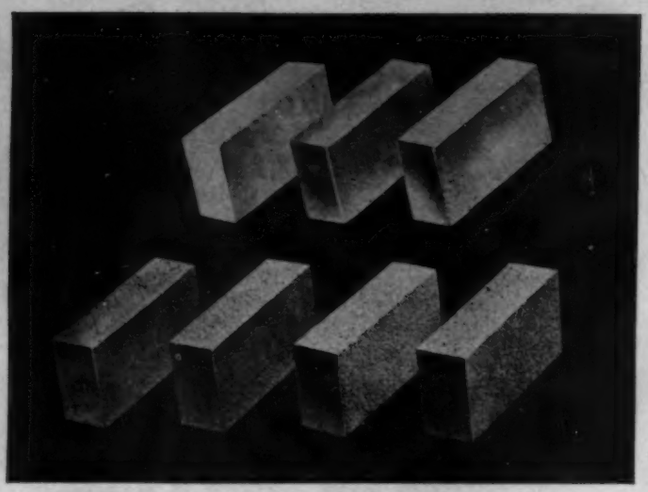
BETTS • BETTS-BRIDGEFORD • NEWTON • COLBURN • HILLES & JONES • MODERN

CONSOLIDATED
MACHINE TOOL CORPORATION
ROCHESTER, NEW YORK

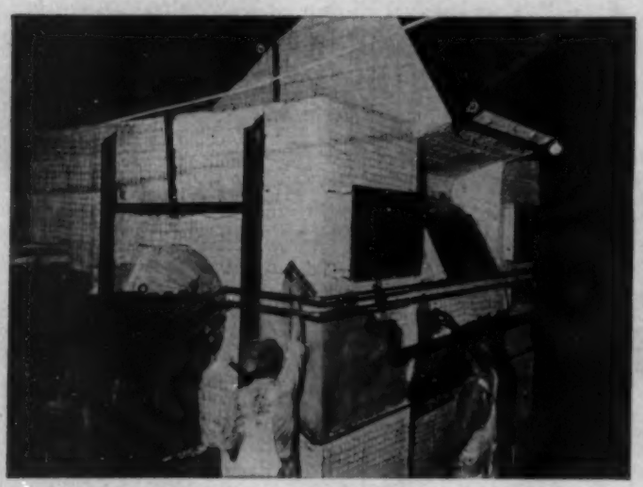
Meet wartime conservation demands with

Johns-Manville Insulations

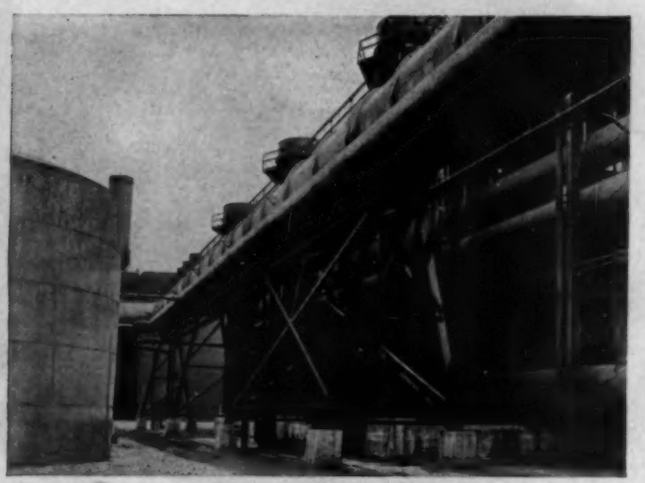
INSULATION FOR TEMPERATURES TO 1900° F. J-M Superex Blocks have long been standard for this service. High heat resistance, low thermal conductivity. Sizes 3" x 18", 6" x 36" and 12" x 36"; from 1" to 4" thick.



FURNACE INSULATION UP TO 2600° F. J-M Insulating Brick and Insulating Fire Brick are available in 7 types, with temperature limits ranging from 1600° F. to 2600° F. All provide light weight, low conductivity.



POWER PLANT INSULATIONS. J-M 85% Magnesia has been for many years the most widely used block and pipe insulation for temperatures to 600° F. and, in combination with Superex, for higher temperatures. Maintains high insulating efficiency. Standard block sizes 3" x 18", 6" x 36" and 12" x 36"; from 1" to 4" thick.



FOR STEAM LINES UP TO 700° F. J-M Asbesto-Sponge Felted Pipe Insulation is recommended where maximum efficiency, high salvage and resistance to abuse are essential. For temperatures over 700°, used in combination with Superex. It is available in 3-ft. lengths, from 1" to 3" thick, for standard pipe sizes.

JOHNS-MANVILLE

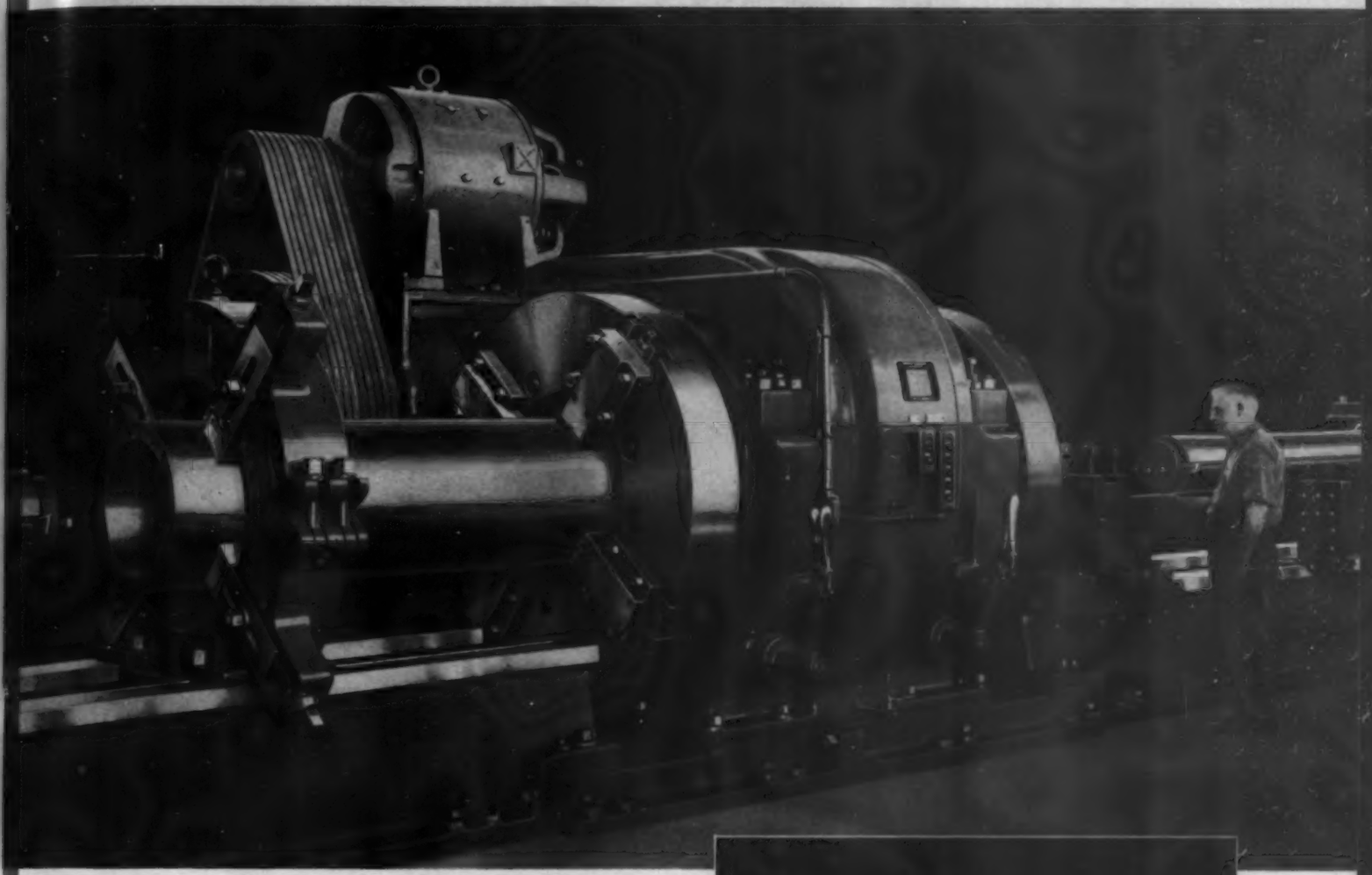
Industrial Insulations

FOR EVERY TEMPERATURE . . . FOR EVERY SERVICE

FOR DETAILS on these materials, and on the complete J-M Insulation line, write for Catalog GI-6A. Johns-Manville, 22 East 40th Street, New York, N. Y.

JM

Wickes DOUBLE-END BORING LATHE



FOR BORING EXTRA-HEAVY HOLLOW FORGINGS UP TO 30" DIAMETER

Torpedo air flasks, big guns and many other kinds of large hollow forgings are today being bored on this Wickes 30" Double-End Boring Lathe. Capacity is up to 30" diameter and up to any length. Range of spindle speeds is ¾ to 29 RPM. Range of feeds is 2½" to 45" per hour. Each end of this lathe is equipped with a separate feed driven by a variable speed D.C. motor with power rapid traverse.

Any length of bed on either end of the machine is

available—and any length and diameter of boring bar may be had. A portable push button station for each end of the lathe gives the operator instantaneous control over the main drive, feed and rapid traverse. A spotting carriage with compound rest is provided for preliminary work on the end of the forging. Write for prices and Bulletin DB-10.

WICKES LATHES CUT COSTS • SPEED PRODUCTION

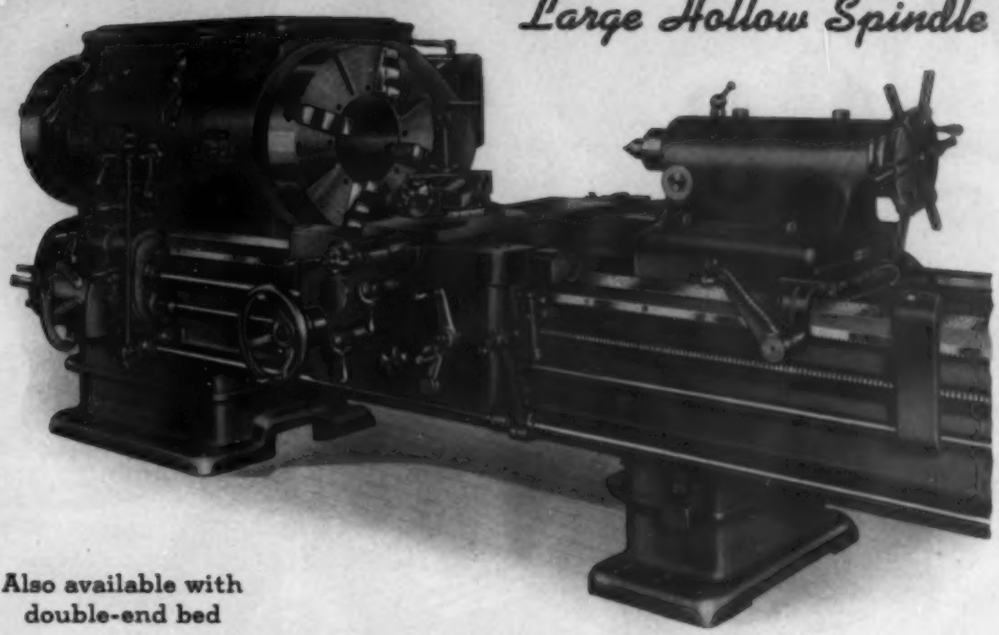
WICKES BROTHERS · SAGINAW, MICHIGAN · EST. 1854

Crankshaft Turning Equipment · Double-End Boring Lathes · Heavy Duty Engine Lathes · Special Production Lathes · Blue Print Machines

INTO THE LINE OF DUTY
WITH BETTER ROLLED STEEL
BETTER FINISH
INCREASED TONNAGE
The Lewis engineer who calls on you will analyze your roll needs in detail and recommend the type of Lewis Roll which will enable you to obtain the best service for the particular rolling in both quality and production.
LEWIS
ROLLS
LEWIS FOUNDRY & MACHINE DIVISION OF
BLAW-KNOX CO. PITTSBURGH, PA.

The HYDRATROL Lathe

Large Hollow Spindle Type



Also available with double-end bed

These Heavy Duty Lathes Have 8 Distinctive Features:

- Easy, Fast, Simple Operation
- Unequalled Capacity for Power Transmission
- Hydraulic Brakes and Clutches
- Absence of Mechanical Troubles
- Essential Operating Information Automatically Presented (on all Standard Models)
- Automatic and Ample Lubrication
- Mechanism Protected by Automatic Control
- Extraordinary Hardness of Bed

18"	Large	Hollow	Spindle	Type	Up	to	7¼"	Hole
24"	"	"	"	"	"	"	12"	"
27"	"	"	"	"	"	"	13"	"
30"	"	"	"	"	"	"	14"	"
36"	"	"	"	"	"	"	16"	"

The HYDRATROL Standard Lathe Is Now Built In Sizes 22", 24", 27", 30" and 36"

Lehmann MACHINE COMPANY

CHOUTEAU AT GRAND ST. LOUIS, MISSOURI

IN 1906 *Midvale made its first hardened and ground rolls for the United States Mint*

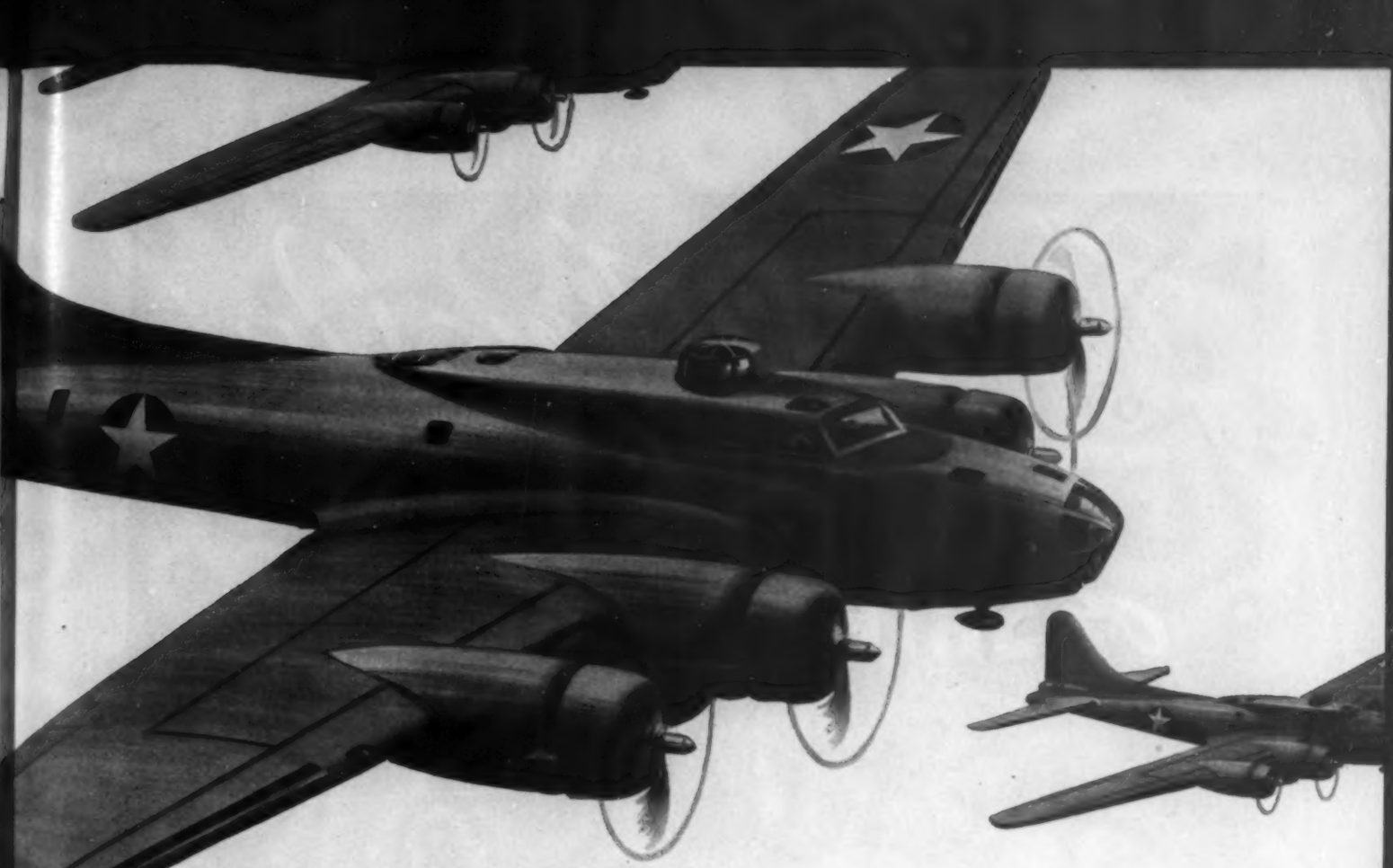
Extreme accuracy was essential because the metal rolled was precious, and the requirements for correct weight, exact. These rolls were a success. Midvale Forged Steel rolls today are used for cold rolling practically all types of metal as well as paper, linoleum, plastics, rubber and food products. Their importance can be gauged by the extent to which sheet metal is found today in home and industry.

1867 75TH ANNIVERSARY 1942

THE MIDVALE COMPANY • NICETOWN • PHILADELPHIA, PA.

OFFICES: New York • Chicago • Pittsburgh • Washington • Cleveland • San Francisco

MIDVALE



An Answer from the skies

"NO FOREIGN power can ever harm Germany from the air" was the boast of Hitler's air marshal. Yet today American planes, piloted by American airmen, are flying far into middle Europe, carrying loads of destruction to the mighty industrial plants—the huge utility system—the network of transportation lines that are all so vital to the Third Reich's military power.

This sky-borne answer to Goering's boast is dramatic proof of the quality of American planes—and the American engines that power them.

For as the size of these planes and the size of the loads they must carry have gone up—and up—and up—the engines that power them have kept pace. Today, motors of 2000 h.p. and over are an accepted fact with engineers looking forward to greater and greater horsepower in the motors of tomorrow.

What this increased horsepower means to the gears that transmit engine revolutions to the whirling propellers can well be imagined.

For aircraft gears must be light in weight, yet the slightest inaccuracy in gears revolving at such high speeds transmitting such great horsepower would quickly spell failure. No wonder aircraft engineers long considered such high precision gears a laboratory product.

But an air armada of the magnitude we are launching demanded that gears be produced by the hundreds of thousands.

That this problem was successfully solved is evidenced by the gears—thousands upon thousands of them—being daily turned out by the Precision Gear Plant of Foote Bros.—gears produced on a schedule that spells doom for the Axis ambition of world conquest.

And when the war is won, these new techniques and new methods that have made extreme precision in mass production possible promise a new era in the design of high speed machines for a peacetime America.

FOOTE BROS. GEAR AND MACHINE CORPORATION
5301 S. Western Boulevard • Chicago, Illinois

FOOTE BROS.

Better Power Transmission Through Better Gears

There's No Time Out FOR MEN or SHIPS!

When the iron ore mines of the Lake Superior District were called upon to supply the needs of the nation—and the ore carriers on the Great Lakes actually moved more than the 92,000,000 tons required in 1942, Cliffs Ore and Cliffs Ships helped do the job!

LAKE SUPERIOR IRON ORE
VESSEL TRANSPORTATION • • • COAL

CCC

THE CLEVELAND-CLIFFS IRON CO.
CLEVELAND • • OHIO

The Policy That Insures

PRODUCTION:

"Standardize on VEELOS"

VEELOS keeps machines running at full speed and productivity because link construction provides quick, easy adjustment . . . reduces machine downtime . . . ends slippage. With Veelos in rolls, strands can be replaced quickly and easily, keeping all belts on the drive and maintaining equal tension. You insure maximum production when you standardize on Veelos for all V-belt drives.

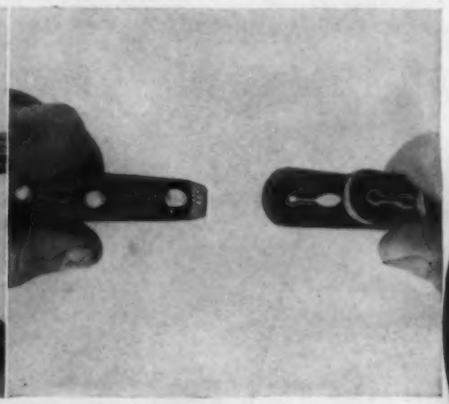
HOW TO UNCOUPLE ALL SIZES OF VEELOS V-BELT

(Note Link Construction)

1. *Hold belt with left hand. Insert screw-driver under top segment as far as slot.*

2. *Hold stock firmly with thumb over screw-driver blade and press handle down.*

3. *Slip tip of blade over rivet head and lift handle enough to pry segment loose.*



4. *Repeat on 2nd rivet for "B"; 3rd rivet for "C"; 4th rivet for "D"; 5th rivet for "E" section belting. Underneath segments removed in same manner until last rivet slips out easily.*

5. *THE BELT IS APART.*

VEELOS

THE LINK

V-BELT

ADJUSTABLE TO ANY LENGTH

ADAPTABLE TO ANY DRIVE

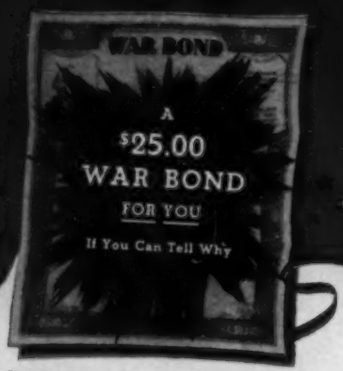
MANHEIM MANUFACTURING & BELTING CO.

MANHEIM, PENNSYLVANIA

"dag"

COLLOIDAL GRAPHITE

IS IMPORTANT in the Manufacture Or Use of These Products



HERE ARE THE RULES

Acheson Colloids Corporation will give a $25.00 War Bond to each of the 5 people who submit complete and accurate answers together with the 5 best letters on the question, "Why is **"dag"** colloidal graphite important in the manufacture and/or use of the twelve products pictured here?" (1) State business connections (no one in the graphite field or their families will be eligible). (2) All entries must be legible. (3) All entries must state the publication in which the advertisement was seen. (4) Entries must be postmarked not later than March 1, 1943. (5) In case of ties, duplicate awards will be made. (6) Entries become the property of the Acheson Colloids Corp. (7) The verdict of the judges will be final.

"dag" COLLOIDAL GRAPHITE AS A HIGH TEMPERATURE LUBRICANT

"dag" colloidal graphite is not only an excellent lubricant at normal temperatures, but it is unique in retaining its lubricating properties at elevated temperatures. It remains unaffected after an liquid lubricant carrier has been completely burned away. Examining on the heated surface, a properly flake form graphite layer.

"dag" colloidal graphite particles are so small that readily pass through the microscopic pores of filter paper. When dispersed in a liquid, all the particles of colloidal graphite become positively or uniformly charged and are carried wherever it extends. Consequently all elements of the surface, exposed to "dag" colloidal graphite in oil are uniformly covered with a protective film. This is not true of powdered graphite because of the wide particle size and its tendency to agglomerate.

properly diluted, will not clog lubricators, oil lines or oil grooves. "dag" colloidal graphite in oil may be used in any type of lubricating system without interfering with its proper functioning. "dag" colloidal graphite is being used with complete success to lubricate the bearings and rubbing surfaces of ovens and furnace conveyors, kiln cars, forging dies, hot piercing tools, stuffing boxes, high intensity searchlights, Cotton predigestors, lathes, movie projectors, and the moving parts of its cutting machines similar to the vulcanization of glass and rubber molds.

Difference Between Colloidal and Powdered Graphite

"dag" colloidal graphite dispersions should never be confused with dispersions of powdered graphite which have not the same properties. "dag" colloidal graphite particles are many times smaller than the particles of powdered graphite — so small they readily pass through the smallest pores of filter paper. In fact they are submicronic in size. Liquid carrier penetrates. The carefully controlled Acheson process of colloidization imparts to these particles a property powdered graphite does not have. This is "force that keeps them" which enables colloidal graphite to remain in suspension indefinitely.

"dag" is a registered trade mark of the Acheson Colloids Corporation.

Write for NEW BULLETIN 423 AZ on the use of "dag" Colloidal Graphite as a High Temperature Lubricant

dag COLLOIDAL PRODUCTS

dag COLLOIDAL PRODUCTS

ACHESON COLLOIDS CORPORATION, Port Huron, Mich.

The Levinson Steel Company

ESTABLISHED 1917

STRUCTURAL STEEL
PLAIN AND FABRICATED

WORKS
20TH AND MERRIMAN STS.
SOUTH SIDE

MAIN OFFICE
33 PRIDE STREET

Pittsburgh, Pa.

To our
many friends:

Quite often I find myself reminiscing on the influences that have led to our present position in the steel industry.

I shall never forget a few words of advice my father passed on to me during his late years. In essence, he spoke thus: "For twenty years I have worked hard in the metal business. I haven't much to show, except a little yard and a lot of friends. Always remember, my son, a few friends are infinitely more valuable than a lot of money. Build your business on a solid foundation; develop a good reputation; be fair, square and reliable and your business will prosper."

To the best of my ability I have always followed this advice and have passed it on to my brothers and to my son.

Our motto in those days was, "We aim to please, we seldom miss," and we really meant it. We aimed to meet every need exactingly and promptly so that as the years went by we obtained an enviable reputation for service.

That was the foundation on which was built The Levinson Steel Company. As structural steel fabricators, and in late years as fabricators of steel for industrial furnaces, conveyors, and other special equipment, we have been commended repeatedly for our excellent workmanship and fine service.

Likewise, as warehousers of steel products, our reputation for service and dependability has become nation-wide. We are proud to point out that despite periods of confusion and price irregularities, we have never charged a premium for any material from our warehouse stock.

In the last few years, when the hazards of material scarcity and shortage of time confronted all of us, there were occasions when our constructive co-operation proved instrumental in eliminating serious work stoppages and prevented break-downs. We are proud to be a part of the Nation's all-out war production. So successfully have we been serving our customers, both old and new, from coast to coast, that competitors and customers alike have congratulated us for outstanding performance.

In the years to come, we pledge never to deviate from the policy that has brought to us so many good friends. We will continue, as in the past, to be fair, square and reliable.

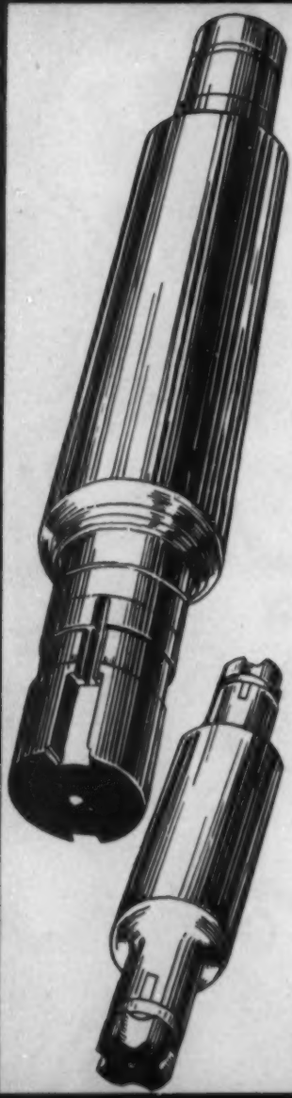
Cordially,

THE LEVINSON STEEL COMPANY

S M Levinson

AMERICAN INSTITUTE OF STEEL CONSTRUCTION
AISC
FOUNDED 1921

NATIONAL ROLLS



Soldiers Without Steel Are Without Power

WAR is now mechanized. Military leaders, while bowing to courage and morale as the strongest spiritual weapons of combat, know also that human strength must be supported by that of the machine.

That means steel, and steel means rolls. Strong rolls, the basic implements in munitions production.

We feel our obligation in producing NATIONAL ROLLS, in both iron chill and grain types, to have them serve as never before. And never before have their heat-timing, alloy proportioning, casting and finishing been so carefully watched, and we are encouraged in this by their performance in the mills.

Our officials and workers, like all others in the steel industry, feel they are helping to hasten Victory and peace for all.

THE NATIONAL ROLL & FOUNDRY CO.

MANUFACTURERS OF
ROLLING MILL EQUIPMENT

"BAIRD" WATER COOLED STANDINGS — "NR&FC" — HEAVY IRON AND STEEL CASTINGS

CHILLED AND SAND ROLLS — SPECIAL IRON ALLOY ROLLS

AVONMORE, PA.

★ THE PUMPS THAT STEEL MILLS BANK ON . . . ROPER

Walk through almost any steel mill in America . . . make a note of the pumps in operation . . . and you'll see Ropers, plenty of them!

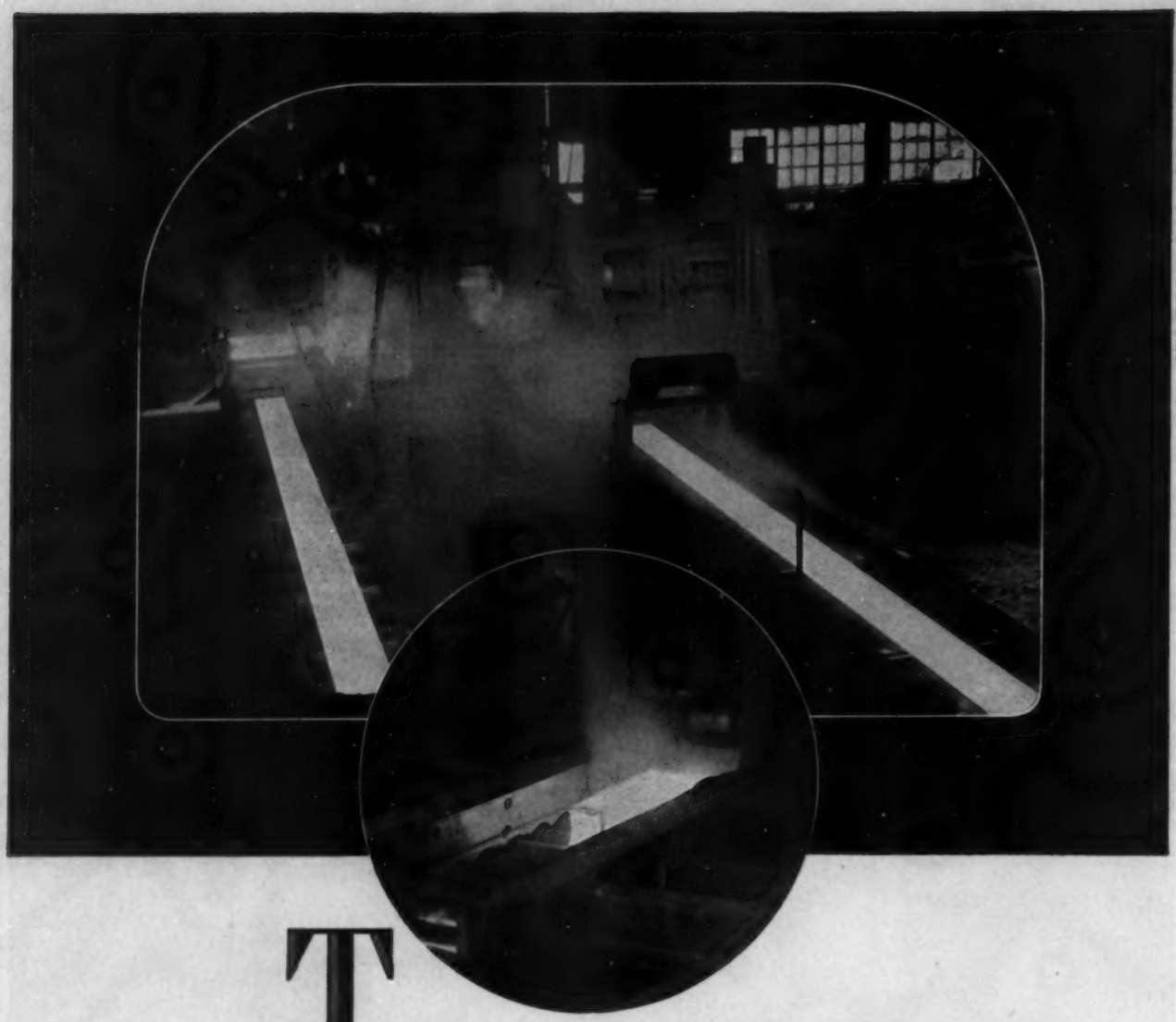
You'll see them used with giant gear drives; stand, rack and manipulator bearings; reversing tables; table rollers; moving parts of screw down mechanisms . . . all operations that require the safest and surest form of constant lubrication under pressure without risk of shutdown.

YOU CAN RELY ON ROPER!

★ WRITE FOR CATALOG 940 WITH COMPLETE INFORMATION

GEO. D. ROPER CORP., ROCKFORD, ILLINOIS

Pittsburgh Office...207-209 BLV'D OF THE ALLIES



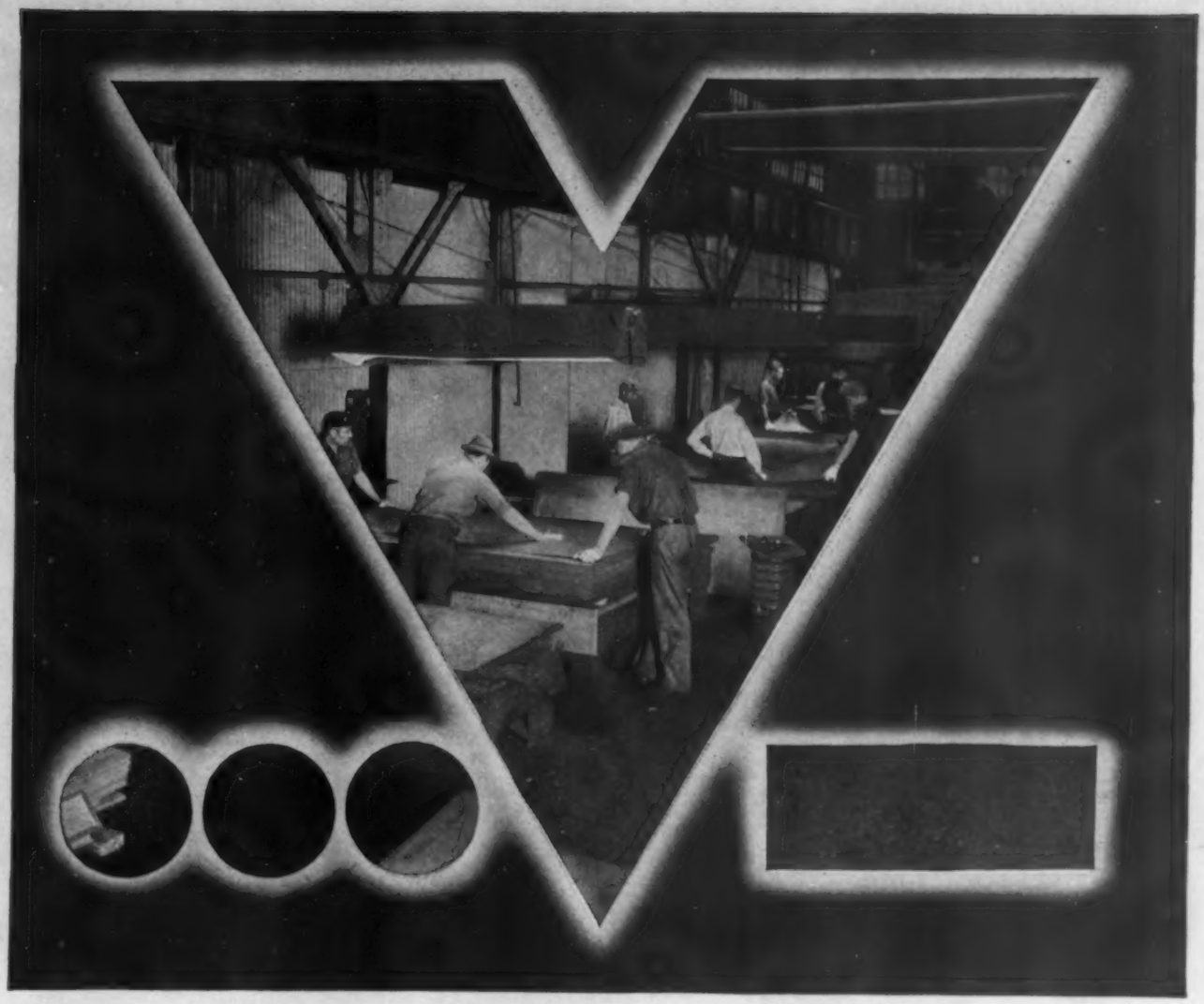
THE HOPE OF THE WORLD

STEEL FOR AMERICA'S PRODUCTION LINES

Upon this nation's ability to produce high grade steel in ever-increasing amounts, depends the hope and security of peace-loving peoples everywhere. To those manufacturing the sinews of war or the needs of a peacetime world, Andrews pledges the finest steel that constant research and production skill are able to achieve. Manufacturers everywhere may rely implicitly upon the high quality of steel for which Andrews has been famous for over 50 years.

THE ANDREWS STEEL CO.
NEWPORT, KENTUCKY
ANDREWS STEEL

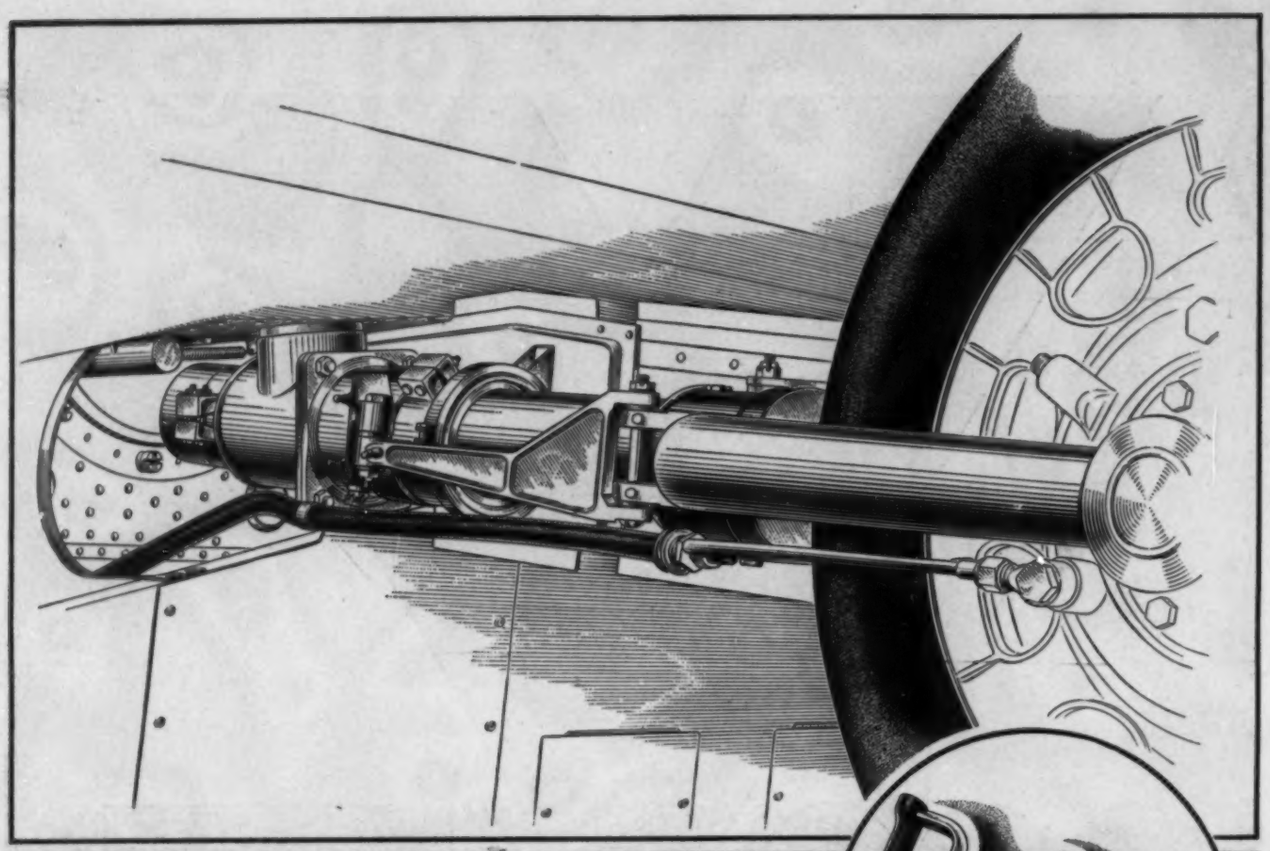
DIVISIONS
THE NEWPORT ROLLING MILL COMPANY
THE GLOBE IRON ROOFING & CORRUGATING CO.



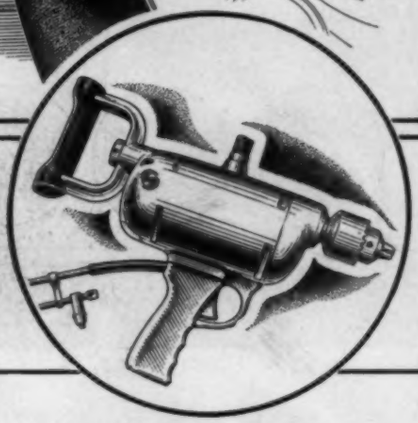
It's the work of many hands that counts...

Here at Newport the rolling of iron and steel sheets goes on day and night. Until the war is won and America returns to peacetime pursuits, the entire organization and its facilities are dedicated unreservedly to manufacturing sheets of unvarying high quality for thousands of war essentials. In this struggle it's the work of many hands that counts, and the men of Newport are proud to have so vital a part in winning the victory that's bound to come soon to America.

THE NEWPORT ROLLING MILL CO.
NEWPORT KENTUCKY
DIVISION OF THE ANDREWS STEEL CO.



what the Landing Gear Learned from the Portable Drill



IT'S A LONG WAY from portable tools to fighter planes—but an idea that works in one often proves just as good in the other.

That's the way it was with the Torrington Needle Bearing. Portable tool builders quickly saw how its unusual features could be used to cut excess ounces out of their product designs—where *every* ounce counts in conserving the operator's energy, in increasing his efficiency.

These same weight-saving features also caught the attention of the airplane designers. When they needed a bearing that would give easy operation to retractable landing gears...stand up under the terrific impact when three tons of fighter plane hits the runway... and still meet the rigid weight requirements of fast, maneuverable aircraft, they found just what they wanted in the Needle Bearing's unique combination of low friction coefficient, high load capacity, and small size—plus its ready availability for war applications. That question of size is doubly important when it comes to weight economies. It means light weight in the bearing itself, of course. But much more important is the fact that housings and other parts can also be made smaller and lighter.

ISN'T THERE AN IDEA HERE FOR YOU TOO, as you get your post-war designs under way? This light-weight trend looks increasingly important, with freight-by-air looming up as the coming means of shipment. While you're studying ways to conserve weight in *your* products, see how well the Needle Bearing fits into your problem. You will find the preliminary information you want in Catalog No. 110—and Torrington engineers will help you in adapting the Needle Bearing to specific applications.

THE TORRINGTON COMPANY

Established 1866 • TORRINGTON, CONN., U. S. A.

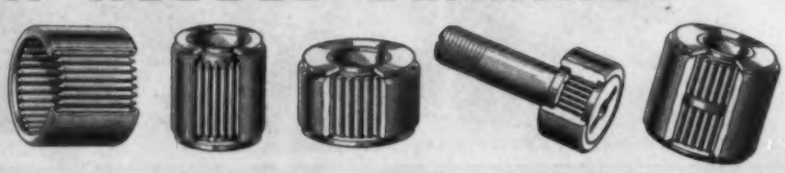
Makers of Needle and Ball Bearings

New York Boston Philadelphia Detroit
Cleveland Seattle Chicago San Francisco
Los Angeles Toronto London, England

TORRINGTON NEEDLE BEARINGS

KEYED TO TODAY'S NEEDS

AND TOMORROW'S TRENDS



Pouring Electric Alloy Steel at Mesta

The Army-Navy "E" Flag, with two stars, flies over the Mesta plant.

MESTA MACHINE COMPANY
PITTSBURGH, PA.

MESTA PRODUCTS

are built in the largest unit plant in the world devoted to the production of ROLLS and STEEL MILL EQUIPMENT

COMPLETE ROLLING MILL EQUIPMENT

Bar Mills
Billet Mills
Blooming Mills
Continuous Mills
Merchant Mills
Non-Ferrous Mills
Piercing Mills
Pipe Mills
Plate Mills
Rail Mills
Rod Mills
Sheet Mills
Shovel Mills
Skelp Mills
Slabbing Mills
Slabbing-Blooming Mills
Four-High Hot Strip Mills
Four-High Cold Strip Mills
Structural Mills
Tin Plate Mills
Tire Mills
Tube Mills
Universal Mills
Wheel Mills

Mesta Patented Flying Shears
Bar Shears
Billet Shears
Bloom Shears
Crop Shears
Hydraulic Shears
Lever Shears
Plate Shears
Slab Shears
Squaring Shears
Steam Hydraulic Shears
Furnace Charging Equipment
Manipulators
Mill Tables
Flexible Couplings
Shear Gauges
Slab Scales
Cooling Beds
Transfers
Conveyors
Pushers
Buggies and Cars
Hot and Cold Saws

Pack Annealing Beds (Fisk Patents)
Annealing Boxes
Gear Drives
Cut and Machine Molded Iron and Steel Gears
Coilers Coil Boxes
Pilers
Mesta Patented Feed Reels
Tension Reels Belt Wrappers
Mesta Patented Sheet Chargers
Electrolytic Cleaning Lines
Continuous Brightening Lines
Mesta Patented Pickling Machines
Continuous Pickling Lines
Processors
Flash Butt Welders for Strip Steel
Seam Welders
Trimmers and Slitters
Stitching Machines
Straightening Machines
Levellers
Scrap Ballers

ROLLS AND MILL PINIONS

Steel and Alloy Steel Rolls
Mesta Grain Rolls
Chilled and Sand Iron Rolls
"Mesta Special" Alloy Steel Rolls
Mesta Hardened Chill Rolls
Nickel Chill Rolls
Mesta Hardened Grain Rolls
Nickel Grain Rolls
Heat Treated Special Alloy Steel Rolls
Backing-Up Rolls
Forged Hardened Steel Rolls
Cut Tooth Mill Pinions
Machine Molded Mill Pinions

FORGINGS

Open Hearth and Electric Furnace Alloy and Carbon Steel

Large Shafts, Ship Shafts, Billets, Blooms, Piston Rods, Connecting Rods, Locomotive Axles, Reaction Towers, Air Bottles, Boiler Drums, Crankshafts, Hollow and General Forgings, Gear Rims, Rolls and Mill Pinions

PRESSES AND EQUIPMENT

Hydraulic and Steam Hydraulic Forging, Bending, and Forming Presses Large Power Presses
Intensifiers Accumulators

SPECIAL MACHINE TOOLS

Heavy Duty Table-type Planers
Heavy Duty Post-type Planers
Heavy Duty Pit-type Planers
Heavy Duty Double Breast Planers
Heavy Duty Draw-Cut Shapers
Heavy Duty Boring Mills
Gear Planing Machines
Combination Shaping, Boring and Milling Machines
Heavy Duty Boring and Turning Lathes
Trepanning Lathes Ingot Slicers
Roll Grinders Roll Lathes
Gear Hobbing Machines

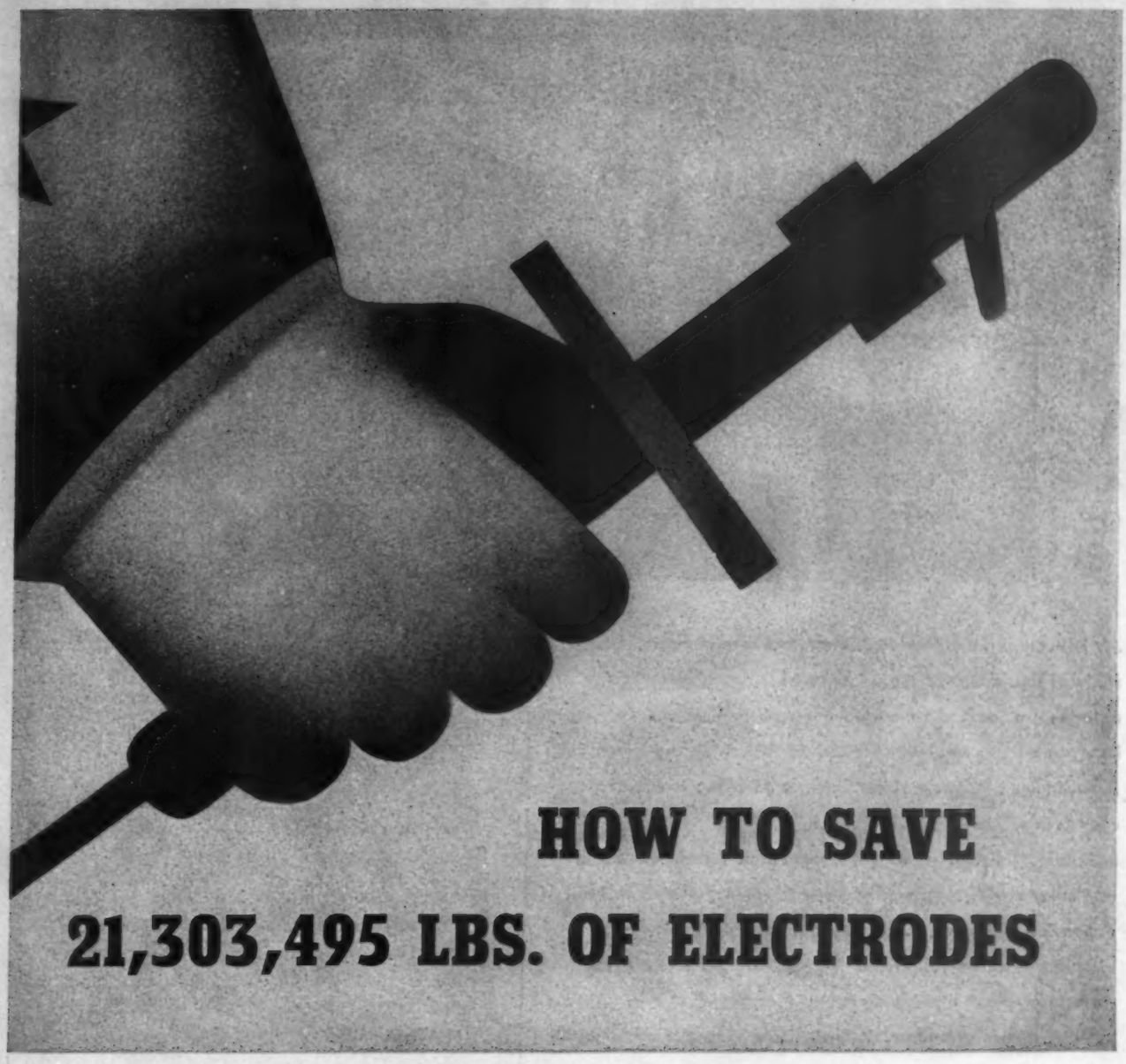
GAS AND STEAM ENGINES FOR BLAST FURNACES, ROLLING MILLS AND POWER PLANTS

Una-Flow Engines (Stumpf Patents)
Piston and Corliss Valve Engines
Reversing Engines
Blowing Engines
Barometric Condensers
Air Heads
Air Compressors
Vacuum Pumps
Mesta Automatic Plate Valves (Iversen Patents)

CASTINGS

Acid Open Hearth, Carbon and Alloy Steel Castings and Forging Ingots, Air Furnace Iron Castings, Bronze Castings

MESTA MACHINE COMPANY, PITTSBURGH, PA.



HOW TO SAVE 21,303,495 LBS. OF ELECTRODES

THE lowly stub end. Only a few inches of metal, weighing about a quarter of an ounce. Yet if it were possible to use half an inch more of every electrode, the reduction in stub end waste would save, at the nation's present consumption rate, approximately 21,303,495* pounds of electrodes annually.

To help stop this waste, use as much of the length of the coated surface as possible, leaving, on the average, a total stub end of no more than 1½ inches; position the work and use the largest sizes and longest rods that are practical.

Have the welders in your organization *turn in all stub ends.* This practice is not only a check on waste, but it helps in the collection of vitally needed segregated scrap.

*estimated on the basis of 3/16" electrodes, 14 inches long.

METAL & THERMIT CORPORATION

Specialists in welding for nearly 40 years. Manufacturers of Murex Electrodes for arc welding and of Thermit for repair and fabrication of heavy parts.

MUREX ELECTRODES

120 BROADWAY, NEW YORK

ALBANY • CHICAGO • PITTSBURGH
SO. SAN FRANCISCO • TORONTO

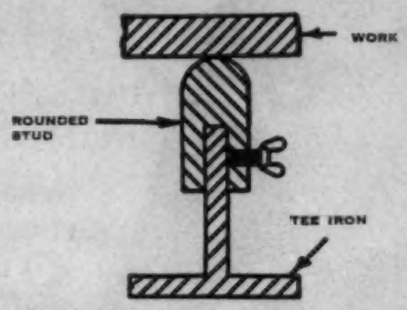
PROPER PLATE SUPPORT Improves Accuracy of Machine Gas Cutting

Air Reduction's Engineering Department recently completed a study of the effects of plate motion in machine gas cutting to determine a method of controlling such motion and thereby increase cutting accuracy. Results of this study are given in detail in an 8-page booklet "Factors Affecting the Accuracy of Machine Gas Cutting."*

In brief the study showed that plate which rests on tee irons or similar rough supports may rotate slightly due to thermal expansion during cutting. This plate movement causes unpredictable inaccuracies in the finished cut plate. By using a method of plate support similar to that shown at right, plate expansion or "creeping" is more closely controlled. Actual production performance has shown that greater cutting accuracy results from use of this type of plate support.

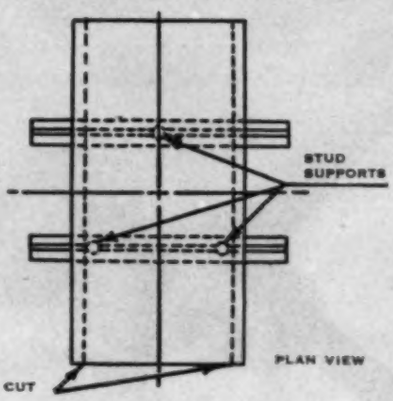
Air Reduction's continuous research program is conducted to help its customers get greater benefits from their Airco products.

Reprints of this booklet will be sent on request to all users of machine gas cutting. Address Air Reduction, Advertising Department, 60 E. 42nd St., New York City.



1 Suggested type of stud support with rounded top that introduces a minimum of resistance to plate motion. The stud section can be moved to any position on the tee iron.

DISTRIBUTION OF SUPPORTS TO PROVIDE BALANCE



2 Supports positioned so as to provide adequate plate balance. Note that supports are inside the line of cut to avoid interference with the cut. The number and position of supports varies with the shape and size of the plate.

BOWED PLATE RESTING ON ALL THREE POINTS

3 Plates are usually bowed slightly, but they can be supported properly by use of the rounded studs.

Air Reduction

General Offices: 60 EAST 42nd ST., NEW YORK, N. Y.

IN TEXAS
MAGNOLIA-AIRCO GAS PRODUCTS CO.
General Offices: HOUSTON, TEXAS
OFFICES IN ALL PRINCIPAL CITIES

AIRCO WILSON

IDLE CYLINDERS ARE PRODUCTION SLACKERS: *Keep 'em rolling for victory!*

ILLINOIS DESIGN

. . . the expression of INGENUITY *plus* EXPERIENCE!

To create a new tooling principle is an achievement of high order . . . to make its application practical requires the "know-how" resulting from years of experience.

★ ★ ★

Your next tool problem may present a need for such abilities. Knowing where they can be found is vital to an effective solution.

★ ★ ★

"Illinois" has these important tool design essentials . . . and, exceptional production facilities as well. A discussion of your particular problems with our engineers will prove it!

ILLINOIS TOOL WORKS

MANUFACTURERS OF METAL CUTTING TOOLS AND SHAKEPROOF PRODUCTS

2501 N. Keeler Avenue, Chicago, Illinois

In Canada: Canada, Illinois Tools, Ltd. Toronto, Ontario

OVERNIGHT TO ALL AMERICA . . .
FROM THE HUB OF AIR TRANSPORTATION

ILLINITE

HOBS • BROACHES • SHAPER CUTTERS • GEAR CUTTERS
MILLING CUTTERS • GROUND FORM TOOLS • SPECIAL TOOLS

"Bound to Get There"

TO THE WAR FRONTS

Steel emergency landing field mats make runways for allied planes on rough terrain. To make the shipment of these mats arrive safely, Acme Unit-Load Bands are used. Inset shows mats loaded in car, Acme Steelstrap-protected.

● All the toil and sweat that have gone into your products is just so much wasted effort . . . if the shipment fails to reach destination in perfect condition . . . whether it's to the fighting front or the production front. Acme Steelstrap guards against transportation hazards . . . assures maximum protection for all kinds of metal products. Acme Steelstrap speeds handling and cuts costs . . . conserves vital shipping space.

Complying with all Federal Strapping specifications, Acme Steelstrap is supplied in all types and sizes. It is used for all kinds of war products packed in boxes, crates, bundles or skids . . . and for bracing carload ladings. Acme engineers will be glad to cooperate with you, too . . . in seeing that your shipments are protected for safe arrival. Write, phone or wire the nearest Acme office.

Acme Unit-Load process of bracing carload shipments provides faster, easier handling of skid loads. Because Acme Steelstrap helps to assure safe arrival, they protect the man-hours which have already been put into your product.

The boys won't be kept waiting for this carton of metal parts . . . destined for the machines of war. It's been made "Bound to Get There" . . . with Acme Steelstrap.

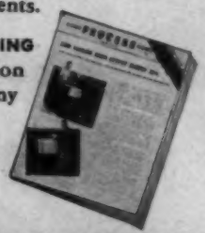
This load of strip steel is ready to be fabricated into war products. Braced with Acme Unit-Load Bands, it is safely protected.

SEND TODAY FOR FREE HELPFUL LITERATURE

ACME PROCESS NEWS . . . issued at regular intervals. This interesting, illustrated publication tells how many war product manufacturers are strapping and bracing their shipments.

STEEL STRAPPING SHIPMENTS . . . gives complete description of various methods of Steelstrapping many types of shipping packs.

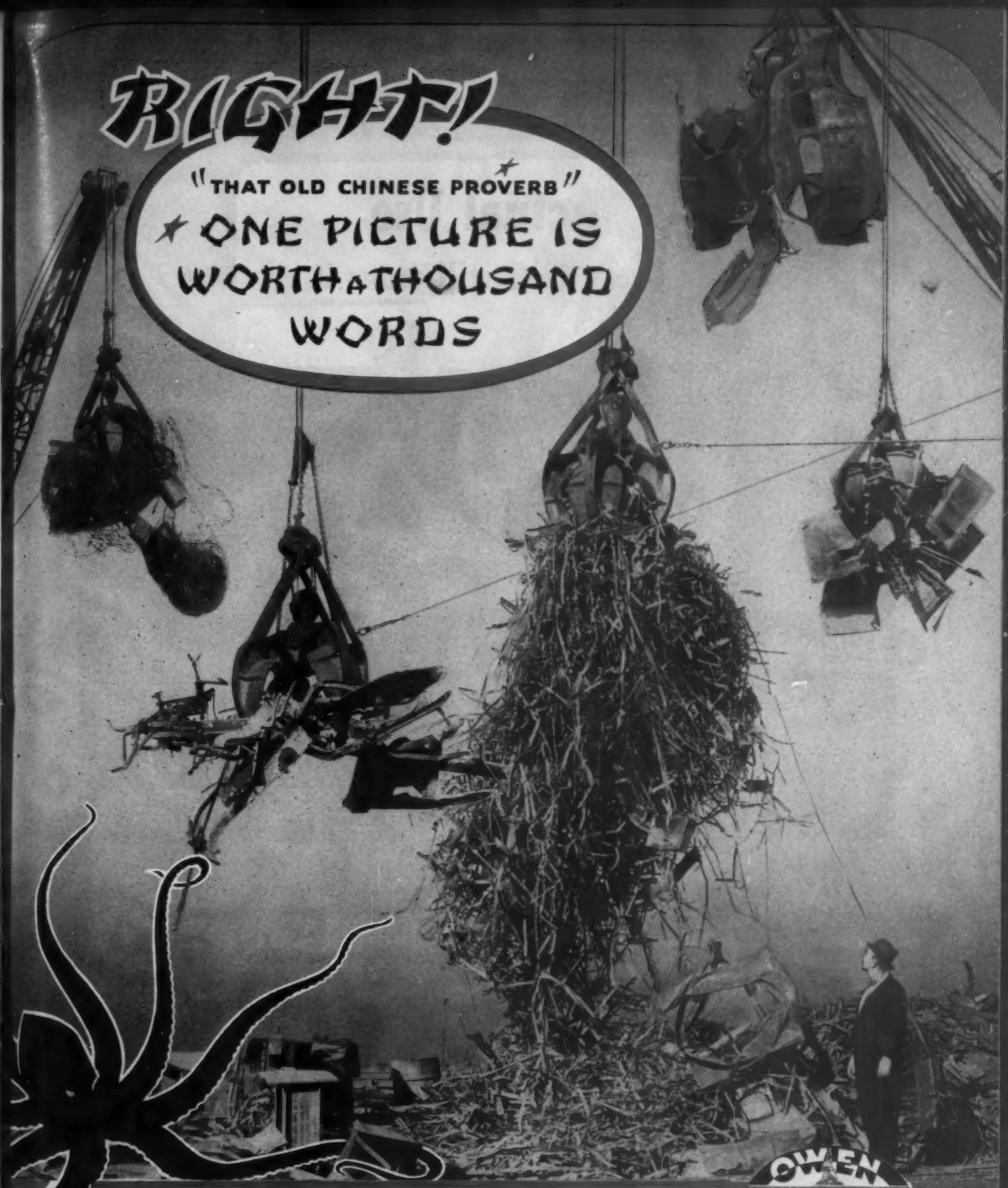
ACME UNIT-LOAD . . . tells the story of bracing carload freight in word and picture.



ACME STEEL COMPANY

2836 ARCHER AVENUE
CHICAGO, ILLINOIS

BRANCHES AND SALES OFFICES IN PRINCIPAL CITIES



THE OWEN BUCKET COMPANY • 6012 Breakwater Ave., Cleveland, O.

OWEN NEW METHOD SCRAP HANDLING

OWEN SCRAP GRAPPLES

BRANCHES: NEW YORK, PHILADELPHIA, CHICAGO, BERKELEY, CALIF.

Actual Use

in Every Case will prove it . . .

HOT DIP GALVANIZING

gives most rust protection per dollar

Actual use is always "the proof of the pudding" . . . yes, in practically every field, under practically every condition, for years and years and years, genuine Hot Dip Galvanizing has demonstrated that it gives you *more* rust protection for *less* money . . . Your maintenance men know that this is true and your laboratory men know why it is inevitable . . . be sure that you get *genuine* Hot Dip Galvanizing by dealing with the qualified Association members listed below . . . Let us send you the complete story; write to American Hot Dip Galvanizers Association, Inc., First National Bank Building, Pittsburgh, Penna.

IF IT CARRIES THIS SEAL IT'S A JOB WELL DONE

Acme Galvanizing, Inc., Milwaukee, Wis. ★ Acme Steel & Malleable Iron Works, Buffalo, N.Y. ★ American Tinning & Galvanizing Co., Erie, Pa. ★ Atlantic Stamping Co., Rochester, N.Y. ★ Atlantic Steel Co., Atlanta, Ga. ★ Buffalo Galvanizing & Tinning Works, Inc., Buffalo, N.Y. ★ Commercial Metals Treating, Inc., Toledo, Ohio ★ Diamond Expansion Bolt Co., Inc., Garwood, N.J. ★ Equipment Steel Products Division of Union Asbestos and Rubber Co., Blue Island, Ill. ★ The Fanner Mfg. Co., Cleveland, O. ★ John Finn Metal Works, San Francisco, Cal. ★ Galvanizers Incorporated, Portland, Oregon ★ Thomas Gregory Galvanizing Works, Maspeth, N.Y. ★ Hanlon-Gregory Galvanizing Co., Pittsburgh, Pa. ★ James Hill Mfg. Co., Providence, R.I. ★ Hubbard & Co., Oakland, Cal. ★ Independent Galvanizing Company, Newark, N.J. ★ International-Stacey Corp., Columbus, O. ★ Isaacson Iron Works, Seattle, Wash. ★ Joslyn Co. of California, Los Angeles, Cal. ★ Joslyn Mfg. & Supply Co., Chicago, Ill. ★ L. O. Koven & Brother, Inc., Jersey City, N. J. ★ The Thomas Laughlin Co., Portland, Maine ★ Lehigh Structural Steel Co., Allentown, Pa. ★ Lewis Bolt & Nut Co., Minneapolis, Minn. ★ Missouri Rolling Mill Corp., St. Louis, Mo. ★ The National Telephone Supply Co., Cleveland, O. ★ Oliver Iron & Steel Corporation, Pittsburgh, Pa. ★ Penn Galvanizing Co., Philadelphia, Pa. ★ Riverside Foundry & Galvanizing Co., Kalamazoo, Mich. ★ San Francisco Galvanizing Works, San Francisco, Cal. ★ The Sanitary Tinning Co., Cleveland, O. ★ Southern Galvanizing Company, Baltimore, Md. ★ Standard Galvanizing Co., Chicago, Ill. ★ Wilcox, Crittenden & Company, Inc., Middletown, Conn. ★ The Witt Cornice Company, Cincinnati, Ohio

Tomorrow may be too late—do it NOW

THIS

MIGHT HAVE PREVENTED

THIS

WARTIME restrictions make copper products hard to get — this includes electrical wire and cable. It will pay you to protect what you have.

Anaconda's Preventive Maintenance Plan will help you check to see that cables in your plant are not being abused.

If you follow this free plan you not only help yourself, but more important, you help the war effort. This manual provides a practical automatic method for complete analysis of circuits and equipment... uncovers potential weaknesses ... methods for correcting them ... with charts to enable quick periodic check-ups.

NOTE: Through this Preventive Maintenance Plan you may uncover the evidence necessary to obtain an "emergency repair priority." This is explained fully in the plan book.

ANACONDA'S PREVENTIVE MAINTENANCE PLAN

Anaconda Wire & Cable Company
25 Broadway, New York City

Please send copy of the Anaconda Preventive Maintenance Plan for safeguarding production.

Individual .....

Company .....

Address ..... City .....

1P

Put Your Screw Driver Army on the DOUBLE QUICK

CUT DRIVING TIME IN HALF!

In today's battle of production, probably more workers are armed with screw drivers than with any other single tool.

Think how many workers in YOUR plant are driving screws . . . and how much time and labor would be saved if you could help them to *drive screws twice as fast!* Chances are you CAN! Hundreds of plants have done just that, by switching to Phillips recessed head Screws.

The scientific centering of driving force in the Phillips Recess eliminates all the handicaps to speed: the fumbling, wobbly starts . . . skidding drivers . . . re-driving of slant-driven screws . . . removal of broken-head screws . . . reclaiming of marred parts. Fast, faultless driving becomes automatic, even for "green hands." Power driving becomes practical for most jobs.

They cost less to use! Compare the cost of *driving* Phillips and slotted head screws. You'll find that the price of screws is a minor item in your total fastening expense . . . that it actually costs less to have the many advantages of the Phillips Recess.

KEY TO FASTENING SPEED AND ECONOMY

The Phillips Recessed Head was scientifically engineered to afford:

Fast Starting – Driver point automatically centers in the recess . . . fits snugly. Screw and driver "become one unit." Fumbling, wobbly starts are eliminated.

Faster Driving – Spiral and power driving are made practical. Driver won't slip out of recess to injure workers or spoil material. (Average time saving is 50%.)

Easier Driving – Turning power is fully utilized by automatic centering of driver in screw head. Workers maintain speed without tiring.

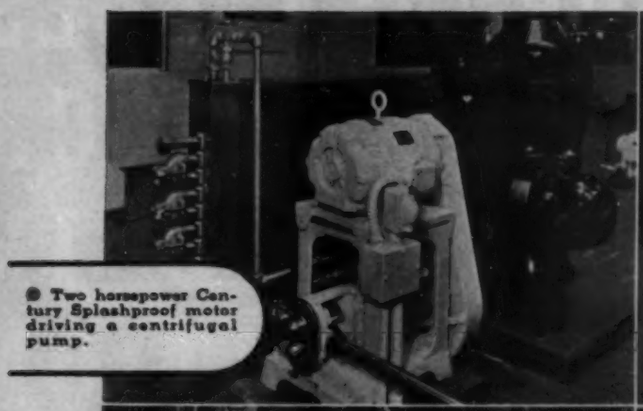
Better Fastenings – Screws are set-up uniformly tight, without burring or breaking heads. A stronger, neater job results.

PHILLIPS *Recessed Head* SCREWS

WOOD SCREWS • MACHINE SCREWS • SELF-TAPPING SCREWS • STOVE BOLTS

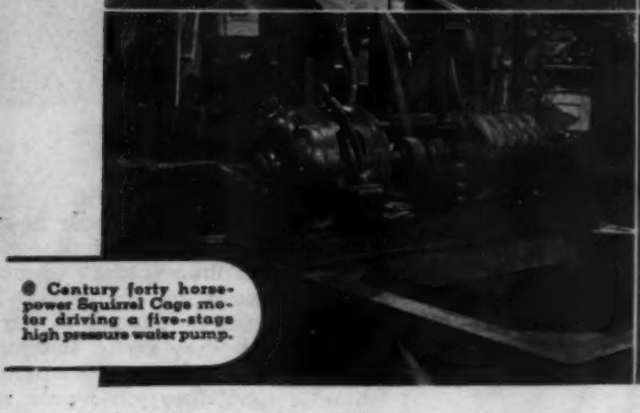
20 SOURCES

American Screw Co., Providence, R. I.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
The H. M. Harper Co., Chicago, Ill.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
The Charles Parker Co., Meriden, Conn.
Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Manufacturing Co., Chicago, Ill.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Manufacturing Co., Waterville, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
Whitney Screw Corp., Nashua, N. H.



● Two horsepower Century Splashproof motor driving a centrifugal pump.

● Century ten horsepower Squirrel Cage motors driving lubricating pumps in a rolling mill.



● Century forty horsepower Squirrel Cage motor driving a five-stage high pressure water pump.

● Two Century five horsepower Explosion Proof motors driving gasoline pumps in a bulk storage plant.

CENTURY MOTORS Meet Your Centrifugal or Reciprocating Pumping Application Requirements In All Types of Atmospheres—on Land or Sea

There's the *right* Century Motor for these and many other pumping requirements:

Water	Gasoline
Oil	Beverages
Brine	Chemicals
Paint	Liquid Drugs

Lubricating Oils and Coolants
Liquid Foods
Hydraulic Machinery
Condensates

—properly protected against these surrounding conditions:

Salt Air
Acid and Alkali Fumes
Dusts
Coolant Spray
Heat and Cold
Moisture
Explosive Grain Dusts (Class II, Group G)
Explosive Gases (Class I, Group D)

Century Motors are built to meet practically every type of pumping application efficiently and effectively — on land or sea.

Depending upon the surrounding operating conditions, pump installations may require *Century Open, Drip Proof, Splash Proof, Totally Enclosed Fan Cooled, or Explosion Proof Motors.*

To assure peak performance, it's important to select the Century Motor with the proper electrical characteristics. These may vary from low starting torque—low starting current for centrifugal pumps, to high starting torque — normal starting current for reciprocating or gear pumps and for starting other dead load applications.

As in other fields, Century's wide range of motor types and sizes makes it an easy matter to apply the correct motor to pumping uses—motors which match the type of liquid pumped, the pressures desired, and the surrounding working conditions. Your nearest Century Application Engineer and Service Organization will gladly help you with any pumping problem. Call him in today.

Century MOTORS

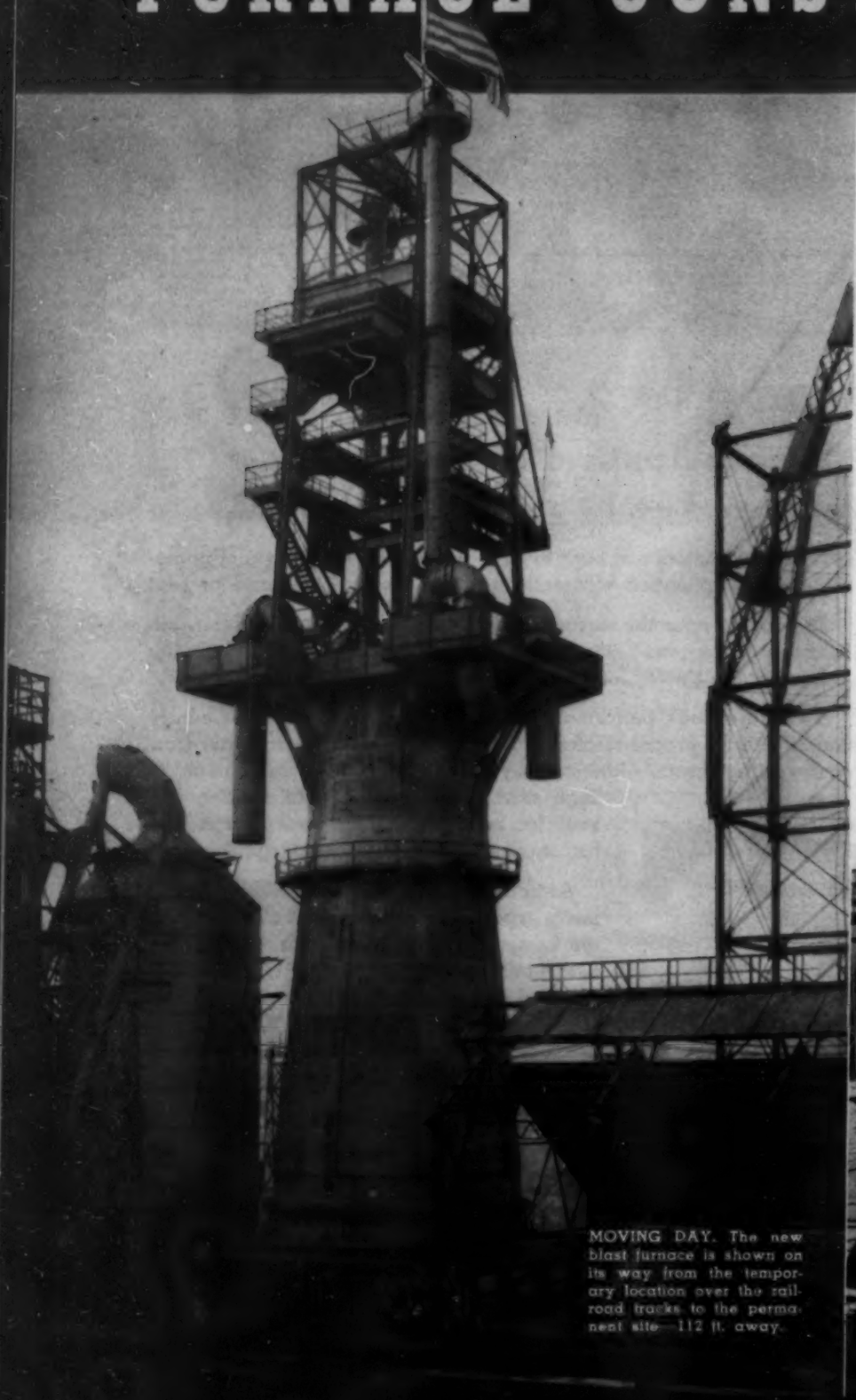
Help You Beat the Production Pressure

CENTURY ELECTRIC CO. • 1806 Pine St., St. Louis, Mo.
Offices and Stock Points in Principal Cities

304

ONE OF THE LARGEST EXCLUSIVE MOTOR AND GENERATOR MANUFACTURERS IN THE WORLD

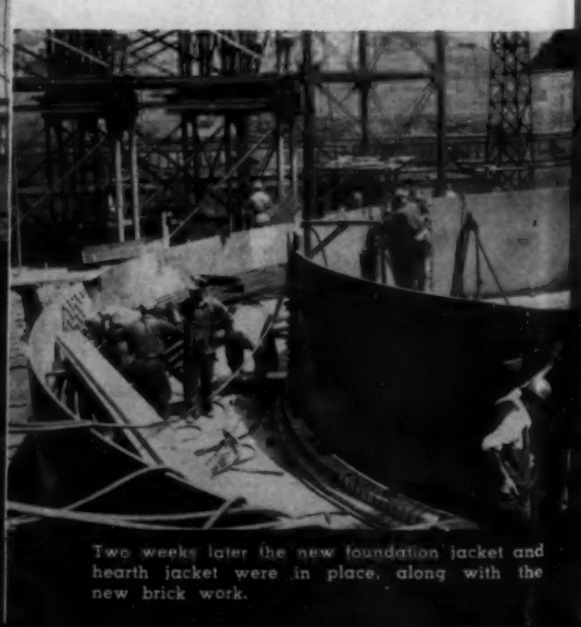
NEW BLAST FURNACE GOES FOR A RIDE AS POLLOCK SETS WORLD RECORD IN FURNACE CONSTRUCTION



MOVING DAY. The new blast furnace is shown on its way from the temporary location over the railroad tracks to the permanent site—112 ft. away.

● A steel plant was totally engaged in important war work, and was confronted with the necessity of making major repairs to one of its blast furnaces, the production of pig iron from which they could ill-afford to lose—particularly over the period of time a rebuilding job would normally take—namely about 150 days. This steel plant was the Campbell Plant of The Youngstown Sheet & Tube Company, and it was the officials of that plant who decided to have The William B. Pollock Company build the new furnace on a temporary site while the old furnace was still producing iron, and then move it over to the permanent location for final connections. The whole rebuilding job was done successfully in 83 days, thus saving 67 days of valuable production or a total of 70,350 tons of pig iron for the war effort.

The Pollock Company can repeat this novel blast furnace feat for you and would welcome your inquiries.

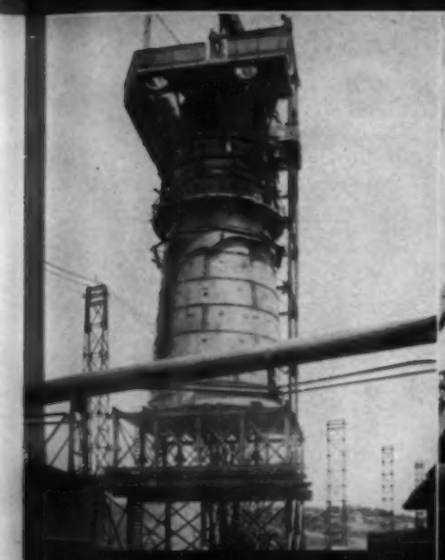


Two weeks later the new foundation jacket and hearth jacket were in place, along with the new brick work.

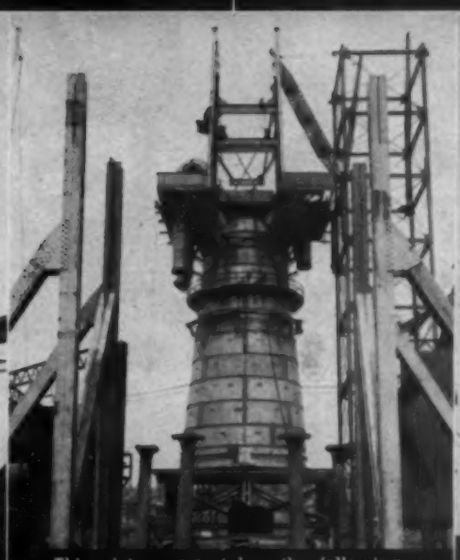
This is the substructure (located 112 ft. from the permanent site) on which the new blast furnace was assembled.

The mantle and 8 rings of the furnace shell were erected in less than a week after the plate work was started.

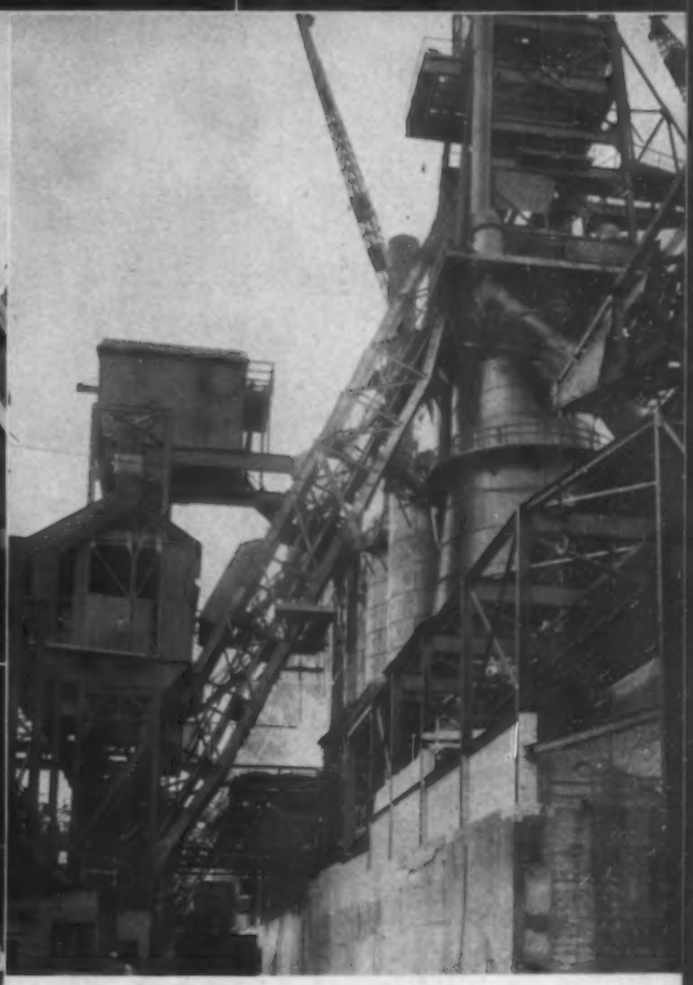
Within another week's time the furnace dome and one of the off-takes were in position.

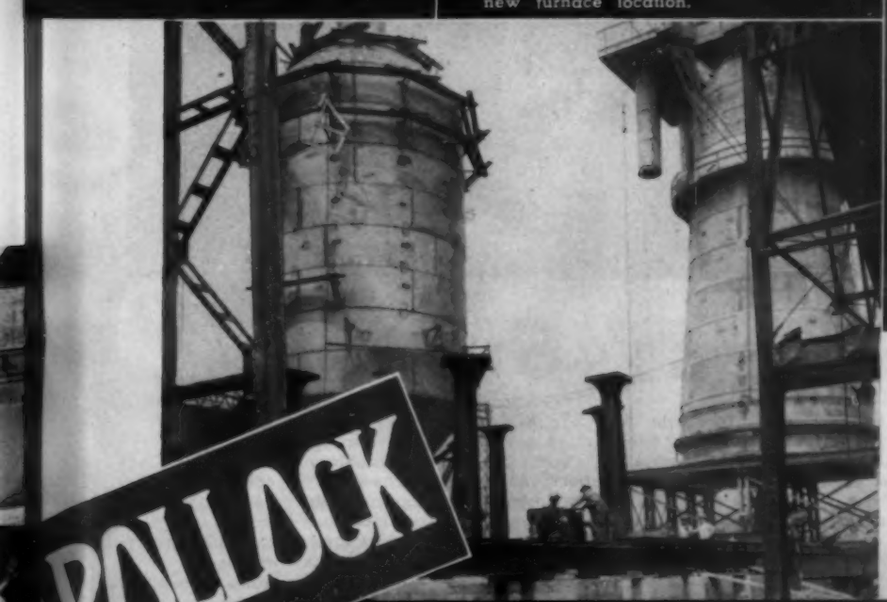


During the next week the furnace top platform and the remaining off-takes were erected.



This picture was taken the following week to show that the old furnace had been dismantled and that preparations were being made for the new furnace location.





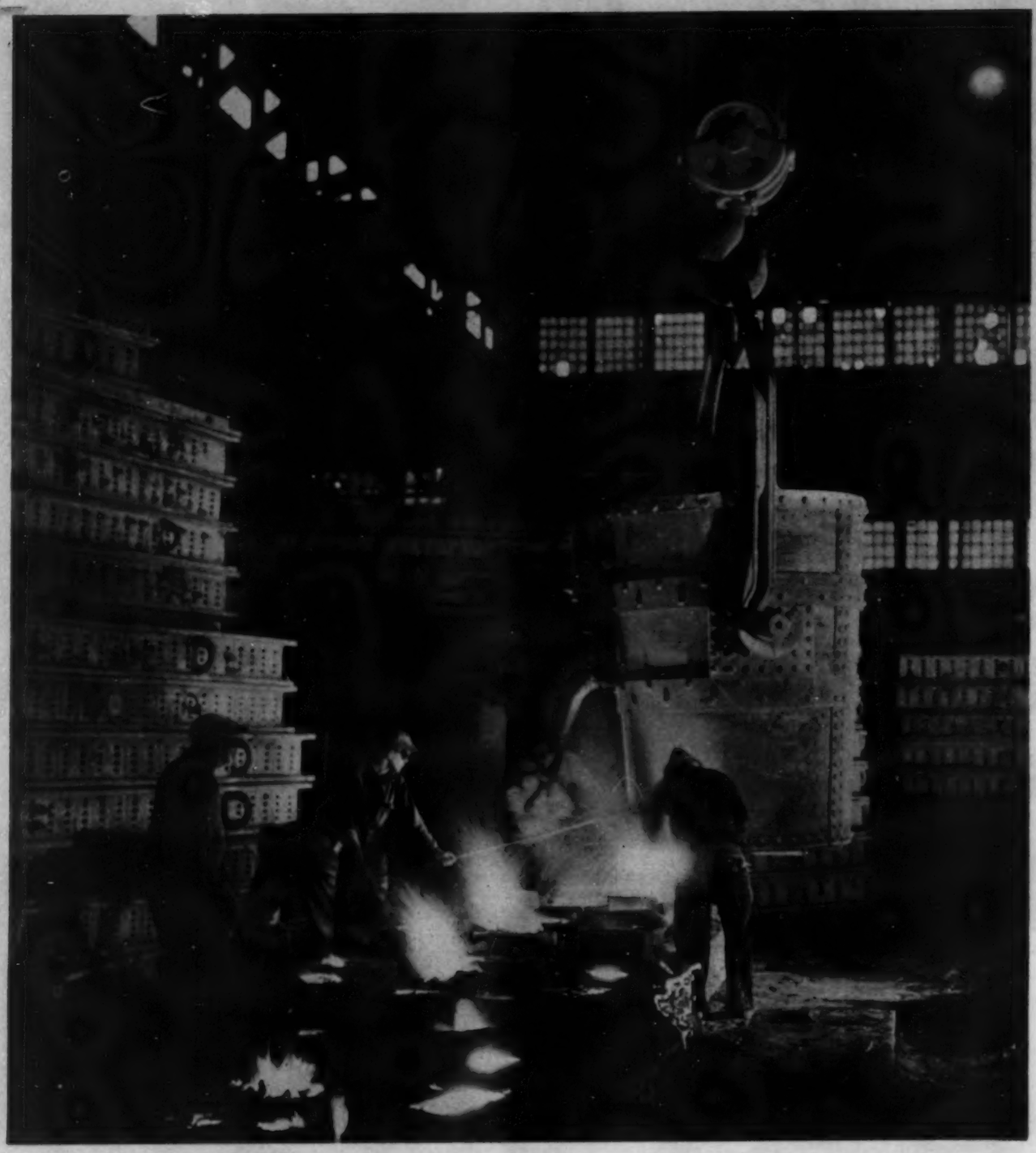
LEFT
Less than two weeks later the furnace was ready to be moved and the trestle was in position over the railroad tracks for the moving.
ABOVE
In the five weeks that followed, all of the construction work was completed, the brick lining was dried out, and the new blast furnace was blown in.

POLLOCK

The WILLIAM B. POLLOCK COMPANY

YOUNGSTOWN, OHIO

STEEL PLATE CONSTRUCTION • ENGINEERS - FABRICATORS - ERECTORS



Casting Steel...THE STRONG WAY!

The flash of the camera's eye brings you into the Strong plant at that dramatic moment when a succession of molds are being poured in the Strong manner. Such a picture obviously could not be "staged" even in these days of photographic wizardry. Consequently it is our thought that by mailing you from time to time similar pictures of Strong operations you will gain a clearer appreciation of the better steel casting that takes place any working day in the exceptionally equipped plant of the Strong Steel Foundry Company.

Whenever you have occasion to think of steel castings, remember that STRONG castings are all that their name implies . . . in precision, tensile strength, ductility, elongation, heat treatment, laboratory control, adherence to specifications, cleanliness and machinability. As this first folder of a forthcoming series comes into your hands, we would also like to add our "strongest" wishes for a year of continued progress for, no matter what happens in the year ahead, may we all hold fast to that faith in America's productive genius which we know will ultimately return this world to a life of sanity, peace and plenty.

STRONG STEEL FOUNDRY COMPANY · BUFFALO · N · Y ·

RECORD!

2318

SHELL FORGINGS

IN ONE DAY

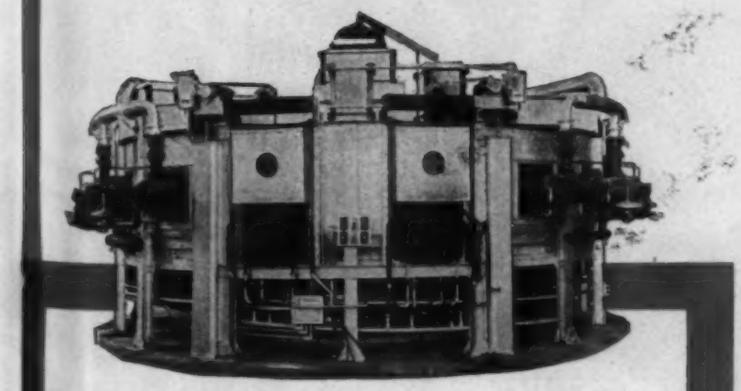
WITH NO REJECTIONS

The record breaking forging crew who produced 2318 shell forgings on a single manufacturing line, with no rejections.

America's Answer

IN THE AMERICAN WAY

WITH HAGAN FURNACES



One Hagan 17′ rotary hearth forging furnace heated 2318 shell forgings during an eight hour shift—no rejections of any kind.

Operating crew on furnace consists of three men—one man charging, one man discharging and one man for relief.

Four additional furnaces have been ordered since the original installation went into service.

Patented construction rotary hearth forging furnace assures uninterrupted operation with uniform control of heating time and temperature. Each billet is delivered at the proper uniform forging temperature — no burned or cold steel — each billet forges the same.

GEORGE J. HAGAN CO.

PITTSBURGH, PA.

Detroit · Chicago · Los Angeles · San Francisco

THERE IS NO SUBSTITUTE FOR EXPERIENCE IN

HOT DIP GALVANIZING

Our plants have the largest and most modern Hot Dip Galvanizing Equipment in the United States, and today, as during the last war, we are cooperating with the Navy Department and all businesses engaged in National Defense.

We are in a position to take on more tonnage to galvanize than we have on order at the present time, and we can make prompt deliveries.

Galvanizing Navy Plates

JOSEPH P. CATTIE & BROS.

Philadelphia's oldest and the country's largest hot dip galvanizers

Established in 1867

LETTERLY & GAUL STS., PHILA., PA.

"Take care of yourself, Dad"

Last year over 180 *million* man-*days* of productive time were lost through industrial accidents—many of them needless. Think how many tanks, ships, guns, planes those 180,000,000 man-days of work would have made! . . . Yes, dad—take care of yourself. Your soldier-son needs your factory production to win.

American Cable **TRU-LAY PREFORMED WIRE ROPE** is helping keep down accidents every day because it is a safer rope to use and handle. **TRU-LAY PREFORMED** resists kinking and snarling. It resists whipping; spools better. Worn, broken and chisel-sharp crown wires refuse to wicker out to jab workmen's hands. They remain in place, making **TRU-LAY** *much* safer to handle.

Use American Cable **TRU-LAY PREFORMED** for your next rope. Do everything possible to reduce lost-time accidents. America needs your full-time production.

TRU·LAY *Preformed*

AMERICAN CABLE DIVISION

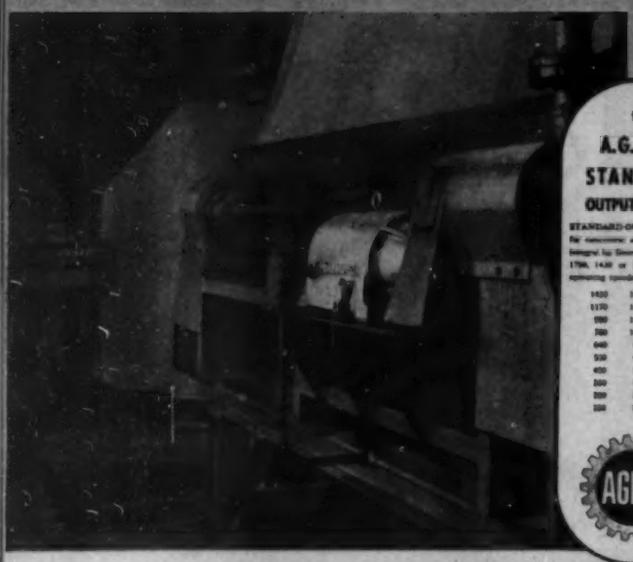
Wilkes-Barre, Pa., Atlanta, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco, Tacoma

AMERICAN CHAIN & CABLE COMPANY, Inc.

BRIDGEPORT, CONNECTICUT

ESSENTIAL PRODUCTS... AMERICAN CABLE Wire Rope, TRU-STOP Emergency Brakes, TRU-LAY Control Cables, AMERICAN Chain, WEED Tire Chains, ACCO Malleable Iron Castings, CAMPBELL Cutting Machines, FORD Hoists and Trolleys, HAZARD Wire Rope, Yacht Rigging, Aircraft Control Cables, MANLEY Auto Service Equipment, OWEN Springs, PAGE Fence, Shaped Wire, Welding Wire, READING-PRATT & CADY Valves, READING Electric Steel Castings, WRIGHT Hoists, Cranes, Presses . . . *In Business for Your Safety*

THERE'S INCREASED PRODUCTION FOR MANY WAR PLANTS IN THESE SHIPMENTS OF MOTOREDUCERS



★ **A.G.M.A. STANDARD OUTPUT SPEEDS**

STANDARD OUTPUT SPEEDS for concentric and parallel shaft, integral fan Speedreducers. Based on 1750, 1450 or 1160 rpm. motor operating speeds.

1400	350	35
1170	175	80
1000	125	112.5
700	100	125
640	84	152
530	60	190
420	50	225
350	42	268
280	37	315
200	35	400

AGMA

The completely-built-in construction of Philadelphia MotoReduceRs with motor and speed reducer in one compact housing greatly speeds-up and simplifies the installation job and gets machines in production faster. In service, their high efficiencies, up to 97%, help get more goods-for-war made. Trouble free operation, that results from balanced design and a construction of the right parts and materials assures an uninterrupted flow of those vitally needed goods.

When planning for a new drive investigate Philadelphia MotoReduceRs first. They're made in horizontal and vertical types in a wide range of reduction ratios and horsepowers. Complete details are found in the MotoReduceR catalog—send for a copy.

PHILADELPHIA GEAR WORKS

INDUSTRIAL GEARS
AND SPEED REDUCERS
LIMITORQUE VALVE CONTROLS

ERIE AVENUE & G STREET
PHILADELPHIA, PA.
New York, Pittsburgh, Chicago

Philadelphia
LIMITORQUE CONTROL
operates all types of valves, etc., safely, economically, from convenient stations.

Philadelphia
GEARS
All types and sizes of industrial gears. Can be supplied in all materials.

Philadelphia
WORM GEAR SPEED REDUCER
right angle drives—vertical or horizontal. Wide range of ratios and horsepowers.

Philadelphia
MOTOREDUCER
The economical self-contained drive. Horizontal or Vertical types—various ratios and horsepowers.

Philadelphia
HERRINGBONE SPEED REDUCER
for heavy loads at high speed. Single, Double, Triple Reductions, various ratios and horsepowers.

Engineers and fabricators find our new catalog a valuable addition to their library on welding equipment. It contains charts and data of current interest. Let us send a copy.

Yet the waste represented by throwing away stubs in excess of two inches totals a surprising amount of material. Material which is scarce —vital to the war program. The operator who uses the maximum utility length and size of an electrode does a service to his employer and his country.

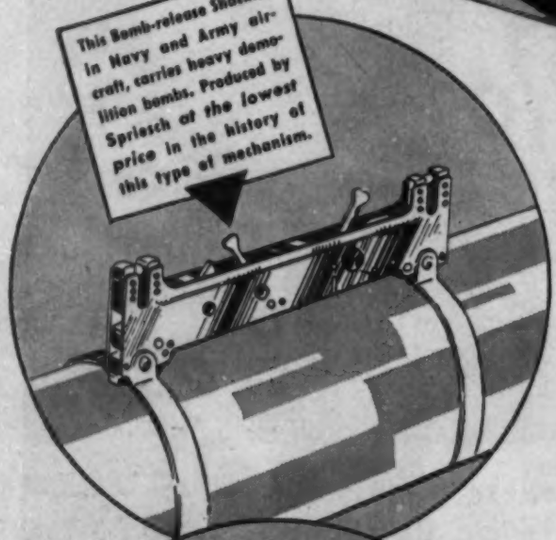
Champion Welding Electrodes produce clean, smooth welds at top speed production. There is a size and style for every job. The skilled welder and the apprentice operator find them easy to handle, satisfactory in performance. Use Champions on that next job—and be assured they will live up to their name.

THE CHAMPION RIVET COMPANY

11200 HARVARD AVENUE • CLEVELAND, OHIO

EAST CHICAGO, INDIANA

Is Your Future Wrapped Up In Our *Bomb Shackles?*



★ No, that is not a far-fetched question. It is possible that your future may be wrapped up in our aircraft armament, Bomb-release Shackles.

★ Let's look at it this way. Today we are producing parts for America's war machine. Bomb Shackles, made to exact specifications, being produced 24 hours a day, 7 days a week. This is war production. In addition our long experience includes serving the U. S. Army since 1928.

★ Out of all this has developed the Spriesch modern war production ability. A production method with the lowest percent of rejections!

★ All right, where is your future in this? Simply turn this recognition by the U. S. Army and Navy of Spriesch ability to originate and produce to your problems.

★ Make sure of your future position in competitive industry tomorrow, by planning now to use Spriesch modern war production ability in peace time.

Joseph J. Cheney, President.

★ *Write for Brochure* ★

Our 36-page brochure titled "Ingenuity" will be sent on request. Please use your business letterhead.

AD No. 11

★ *Spriesch*

Established 1923

TOOL & MANUFACTURING CO., Inc.

10 HOWARD STREET BUFFALO, NEW YORK

★ ★ ★

GET IN THE SCRAP

One ton of your idle scrap makes two tons of fighting steel. Search your plant again and again—every pound of scrap is important.

What Continental Steel is Doing Better for War Today . . . It Will Do Better for You Tomorrow

The production of steel and steel products to meet the varied demands of war is building a reserve of specialized metallurgical information and production experience at Continental. This fund of knowledge will be at your call when the war ends. Continental will be better equipped than ever to meet your needs in steel sheets, manufacturer's wire and steel products, and to work with you on your plans for new products and new production. We invite your inquiries.

CONTINENTAL STEEL CORPORATION

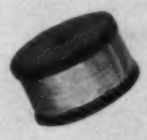
KOKOMO, INDIANA

(The Superior Sheet Steel Company, Canton, Ohio—a subsidiary)

WIRE

Continental manufacturer's wire is made in sizes up to ⅝ inch . . . in standard and special shapes . . . and a wide range of finishes.

FINE WIRE



Fine wire is produced as small as 34 gauge in many finishes including coppered and tinned, and on spools or coiled.

CHAIN LINK FENCE

This modern fence guards war production plants, factories, homes and institutions all over the country. Made in eight different styles.

GALVANIZED SHEETS

Continental's SUPERIOR, COPPERIOR, and CHECKER COAT sheets are well-known among manufacturers and sheet metal workers for workability and uniformity.

SPECIAL SHEETS

Typical of special sheets is SUPERIOR GALVANNEALED. Its special heat-treated zinc coating "takes" and "holds" paints and is highly rust resistant.

STEEL ROOFING

There are 14 styles of Continental steel roofing and siding including corrugated, V-crimp, Drain Rite and Tyl-Lyke.

CONTINENTAL STEEL CORPORATION

PRODUCERS OF—SHEETS: Black, Galvanized, Copperior, Hot and Cold Rolled, Special Coated, Long Terne, etc.
WIRE: Bright Basic, Annealed, KONIK, Coppered, Tinned, Special Manufacturer's, etc.

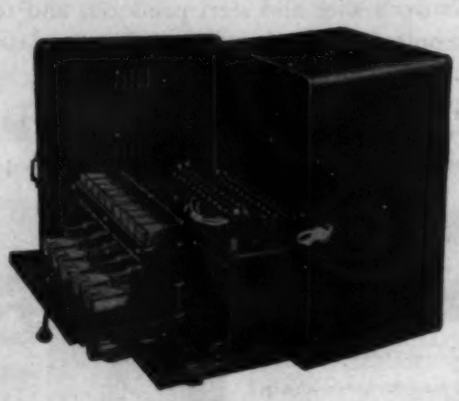
changing a radio tube

TO REPLACE PLUG-IN RELAYS IN NEW WESTINGHOUSE SEQUENCE AND AUTOMATIC WELD TIMERS!

New Westinghouse Sequence and Automatic Weld Timers are designed so that all operating parts are easily accessible and quickly replaceable. Maintenance, when needed, is simplified . . . changeovers of timing panels speeded. Valuable production time on aluminum and critical alloys is saved without any sacrifice in precision.

Timing circuit relays, for example, are special, telephone plug-in type. When it's necessary to change them, they can be replaced as quickly as a radio tube! There's no waste motion in other maintenance work either. Special swing-out panels make every internal part readily accessible. All wiring, sockets and bases are color coded, so that circuits are easy to trace. Terminal blocks are of the solderless connector type.

Automatic Weld Timers control timing of weld current and electrode operation where synchronous timing is not desired. *Sequence Timers* are used only to time sequence of electrode operation where duration of weld current is adjusted by Synchronous Control. Eighteen different NEMA standard types are interchangeable in the one standard cabinet. Write today for Bulletin 3079. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., Dept 7-N.



CHANGE CONTROLS . . . IN 3 MINUTES!

With one basic installation, you can change control for any of 18 different resistance weld operations—in less than three minutes! Entire timing panel is released by single thumbscrew. All connections to main transformer panel are made by plug and receptacle. No special wiring is needed.

J-21189

Westinghouse

RESISTANCE WELDING CONTROL

IF IT'S PIPING CONTACT FLORI

OUR scope: Fabricated Piping...for steam, water, air, oil, gas, chemicals

Random mill or cut lengths, bent, coiled, welded, flanged, threaded. Valves, Pipe Fittings.

In brief: anything in tubular or plate steel fabrication.

Our customers: United States of America and Allied Nations.

Send us your inquiries.

FLORI PIPING

THE FLORI PIPE COMPANY • ST. LOUIS, MO.

Important Announcement!

Effective January 1, 1943, the name of Scully Steel Products Company was changed to United States Steel Supply Company

Scully... for many years a member of the family of United States Steel Subsidiaries — now takes a name which more fully represents its ability to serve you with a comprehensive list of steels and steel products.

Only the name has been changed. The same personnel in our eight conveniently located warehouses will continue to do their best to take care of your needs.

The prompt and courteous service that has made the name "Scully" famous will be maintained.

The addresses and phone numbers of our warehouses remain the same.

As always, we stand ready to give our customers every help we can in getting the right steel as promptly as possible.

UNITED STATES STEEL SUPPLY COMPANY

Distributors of Steel and Steel Products

CHICAGO
BRunswick 2000
Teletype CG. 605

BOSTON
STAdium 9400
Teletype BRTN 10

CLEVELAND
HEnderson 5750
Teletype CV 153

ST. PAUL-MINNEAPOLIS
NEstor 2821
Teletype STP 154

PITTSBURGH
CEdar 7780
Teletype PG 475

BALTIMORE
GILmore 3100

ST. LOUIS
MAin 5235

NEWARK, N. J.
BIgelow 3-5920—BErgen 3-1614—REctor 2-6560
Teletype NK 74

USS

UNITED STATES STEEL

BETTER . . . . . CHEAPER
WITHOUT WASTE

HERE'S HOW

• TO SAVE BLAST CLEANING POWER •
• TO OFFSET LABOR CONSCRIPTIONS •

IN 1943

NORTH BROTHERS Manufacturing Company of Philadelphia had to clean a greatly increased volume of work in *less time than ever before, with a labor force deeply cut by the draft, and in a limited cleaning room space.* A Pangborn Airless ROTOBLAST Barrel was installed to answer the problem. Now, after ten months operation, production has more than doubled and cleaning costs have been reduced 37%. "Without this equipment," they write, "we never could have handled the vast increase of our business which we have handled during the past year."

Railroads need all available equipment for staggering war service. Repair and maintenance time must be cut to new minimums. At the repair yards of the Western Maryland Railroad a new Pangborn blast Room permits the largest locomotives to have boilers and tubes cleaned by two operators in two days time. Formerly this job required a gang of men with steam and wire brushes from one to two weeks to complete.

Tank armor plate is hard to clean. Pouring temperatures and annealing temperatures both produce hard scale. At a well known Rochester plant a large Pangborn Table, throwing 390 pounds of steel abrasive from each of two ROTOBLAST units per minute, cleans through such scale down to virgin metal in two passes with table speed at 2 r.p.m. Customer well pleased with results.

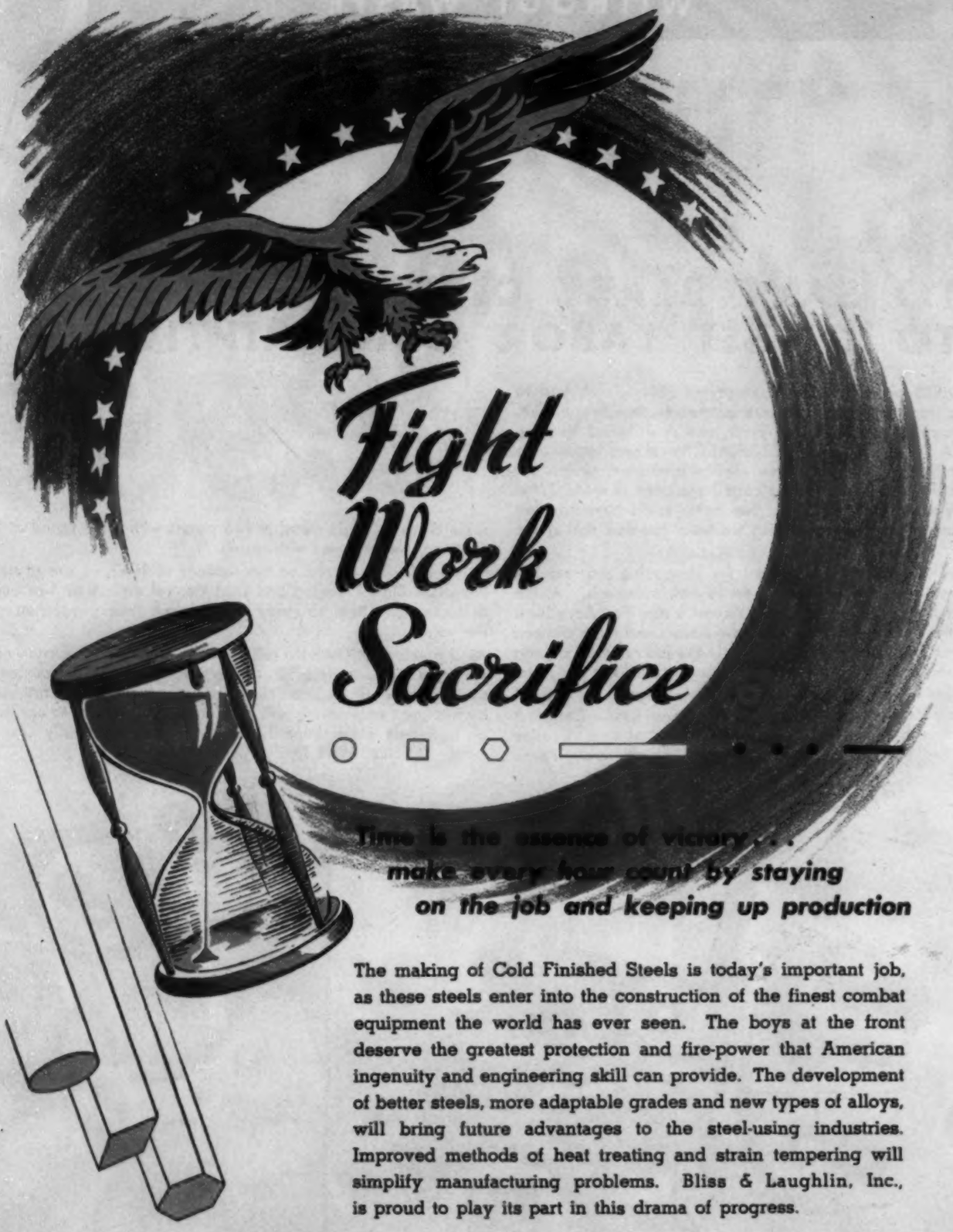
As we close the record on transactions of 1942 we are grateful that Pangborn Blast Cleaning and Dust Control equipment has been able to successfully help so many plants reach their production goals of the year.

As a preview of 1943 we tell you that our own production of equipment will increase, delays in delivery will be shortened, our equipment performance will be improved as quickly as advances are suggested by the finest engineering skill obtainable, and service to our thousands of customers given honestly, promptly and with only one end in mind—*TO HELP WIN THE WAR IN 1943!*

WORLD'S LARGEST MANUFACTURERS OF BLAST CLEANING AND DUST COLLECTING EQUIPMENT

PANGBORN

PANGBORN CORPORATION • • HAGERSTOWN, MD.



Time is the essence of victory . . .
make every hour count by staying
on the job and keeping up production

The making of Cold Finished Steels is today's important job, as these steels enter into the construction of the finest combat equipment the world has ever seen. The boys at the front deserve the greatest protection and fire-power that American ingenuity and engineering skill can provide. The development of better steels, more adaptable grades and new types of alloys, will bring future advantages to the steel-using industries. Improved methods of heat treating and strain tempering will simplify manufacturing problems. Bliss & Laughlin, Inc., is proud to play its part in this drama of progress.

COLD DRAWN BARS • STEEL SHAFTING • SCREW STOCK • ANNEALED BARS • ALLOY STEELS

BUY WAR BONDS
Save Scrap Metal
Conserve Equipment

BLISS & LAUGHLIN, INC.

HARVEY, ILL. — Sales Offices in All Principal Cities — BUFFALO, N. Y.

a case for Cleveland Presses

There are several different types of Cleveland Power Presses used in the production of shell cases, each type being particularly suited to perform a given operation or series of operations, such as heading, sizing, drawing, indenting, etc., efficiently and economically.

Maximum production is attained through the use of automatic dial feeds designed by Cleveland Engineers especially for shell case manufacture, and any shell Manufacturer who is contemplating installing additional Presses to accommodate the change over from brass to steel shells, can promptly obtain complete information on Cleveland Presses with automatic dial feeds, on request.

THE CLEVELAND PUNCH & SHEAR WORKS CO. CLEVELAND · OHIO

THE SHENANGO FURNACE COMPANY

Lake Superior Iron Ores { Bessemer • Non-Bessemer / Aluminiferous

"Shenango" Pig Iron .. { Bessemer / Malleable / Basic / Foundry

SHENANGO-PENN MOLD COMPANY

PLANT DOVER, OHIO

Centrifugally Cast

BRONZES • MONEL METAL • ALLOY IRONS

Rolls, Propeller Shaft Bearings, Bushings and Bearings

SHENANGO-PENN MOLD COMPANY

INGOT MOLDS AND STOOLS

Plants

Sharpsville, Pa. • Pittsburg (Neville Island)

W. P. SNYDER & COMPANY

Established 1888

Iron Ore • Coal • Pig Iron • Coke

OLIVER BUILDING • PITTSBURGH

The HYDRO-ARC Electric Furnace has HYDRAULICALLY POSITIONED ELECTRODES

● Here is an outstanding development in electric melting furnaces, offering advantages not available elsewhere. *Low inertia* counterbalancing and small reversing pump motors (which do not surge above their full current rating) result in (1) highest electrode speeds on automatic control, (2) most accurate positioning. The electrodes start and stop instantly in cooperation with the new automatic controls. There is less surging . . . . improved power factor . . . . less transformer heating . . . . less carbon pick up . . . . less electrode usage. The entire furnace is surprisingly simple in design. It is the product of experienced engineering . . . . careful manufacturing . . . . rigid inspection . . . . and conscientious service. The Hydro-Arc furnace has other exclusive features. Ask us to explain them.

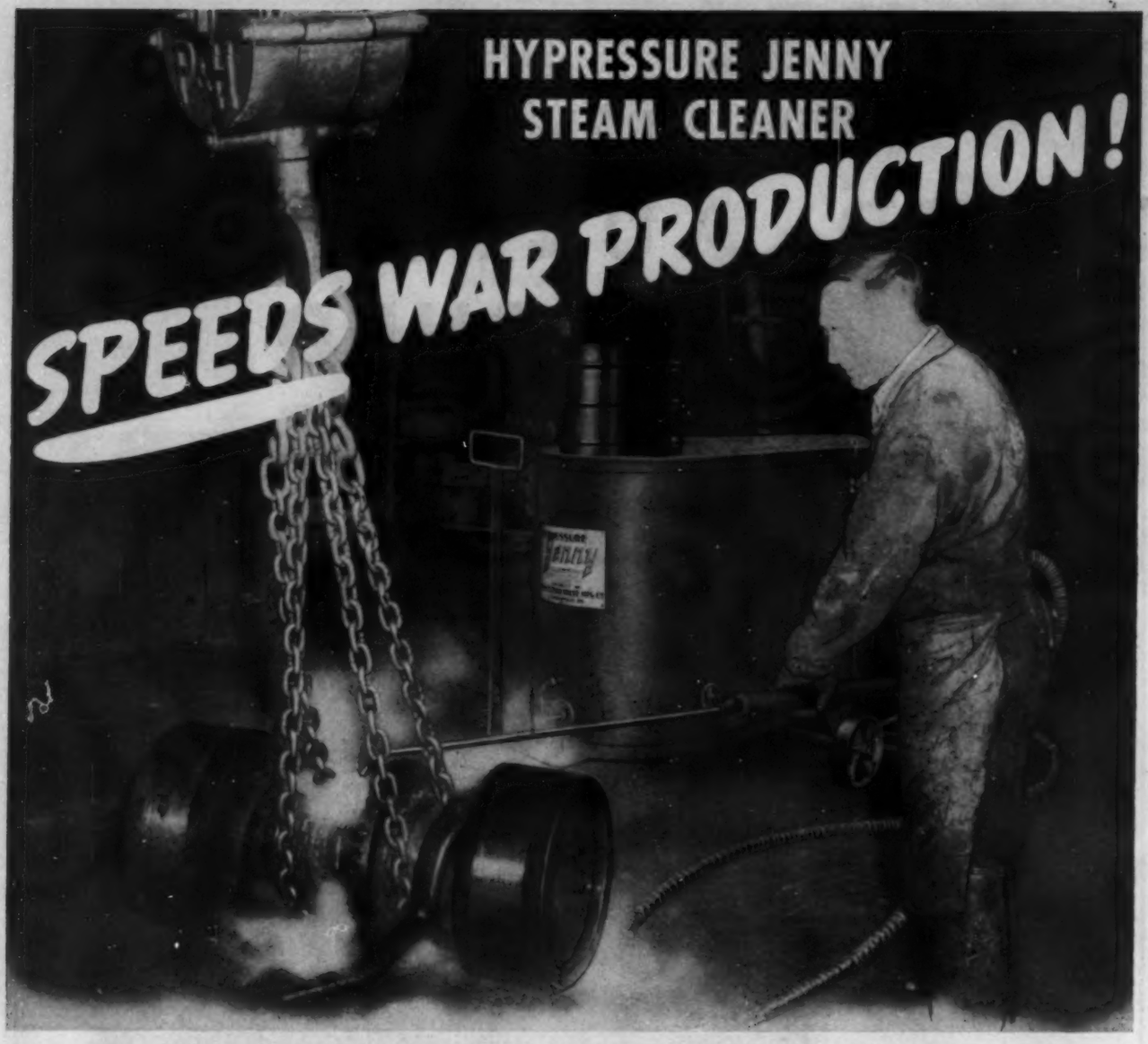
OUR NEW PLANT — *The above building houses our general offices, engineering department and complete machine welding and structural shop.*

HYDRO-ARC FURNACE CORPORATION

Telephones: La Grange 4545 and 4546
Chicago Line: Enterprise 1068

561 Hillgrove Ave., La Grange, Ill.
(a suburb of Chicago, Ill., U. S. A.)

Associated with Whiting Corporation



How can a Steam Cleaning machine step-up war production? Hypressure Jenny answers that question by freeing production equipment from speed-retarding dirt and grease in one-seventh of the time required by hand methods; cleaning "like new", old machinery for faster rehabilitation; shortening machine layups by saving 25 to 40% of mechanics' time usually lost wiping dirt and grease from tools and equipment; uncovering cracks and defects before serious damage occurs; releasing vital men for productive work; keeping mill and factory floors safely clean for fast plant traffic! Tell us your cleaning problem . . . we'll show you how Hypressure Jenny can lick it.

HYPRESSURE JENNY DIVISION OF

HOMESTEAD VALVE MFG. CO.

MAKERS OF "PEAK PERFORMANCE" VALVES FOR 50 Years 1892 1942

P. O. BOX 22 • • • CORAOPOLIS • • • PENNSYLVANIA

DOW

Dow operates extensive fabrication facilities for the manufacture of Dowmetal castings and wrought products. These activities are supplementary to Dow's production of magnesium, which began 26 years ago with the extraction of this lightest of structural metals from the brine of Michigan wells and is now augmented by the recovery of magnesium from sea water. Thus every effort is being made to meet constantly increasing demands for a strategic material that is essential to the construction of our airplanes.

MAGNESIUM

THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN

PRODUCER OF THE LIGHTEST OF LIGHT METALS SINCE 1916

INGOT • CASTINGS • FORGINGS • SHEET • STRIP • PLATE • EXTRUSIONS

Stainless and Alloy Steels

STRIP and SHEET

BY SHARON

Sharon's modern, greatly expanded facilities for the production of stainless and alloy strip and sheet are an important factor, not only in helping to supply the vast quantities of steel which the thoroughly mechanized warfare of today demands, but in meeting the new requirements of specific, high qualities as well. Sharon anticipated such needs, and prepared to meet them, in advance of actual calls. Yet, the point cannot be stressed too much that Sharon's facilities and those of the entire Steel Industry, unparalleled by any other nation, are dependent upon YOUR support of sustained scrap salvage to attain the necessary goal. Your scrap is serving an irreplaceable function in winning an American peace . . . a peace that will see more things for more people out of more and better steels.

THROW YOUR SCRAP INTO THE FIGHT

SHARON STEEL CORP.

Sharon, Pa.

COVER MORE GROUND *with*

You can cover an astonishing lot of ground in area, work handled and output — with a WALKER-TURNER RADIAL DRILL. Handles all light drilling, tapping and routing at any point within a 62" circle. Spindle speeds from 160 to 8200 r.p.m. Distinct advantages are; 1—Prompt shipment to war industries. 2—Compactness permits installation at any point in production line. 3—Women operators find them easy to operate and unskilled labor can learn to handle them with very little breaking-in. 4—Standardizatiton and quantity production permit an exceptionally reasonable price for a machine tool of high quality of design and materials. Send for literature.

WALKER-TURNER COMPANY, INC.
5013 Berckman Street, Plainfield, N. J.

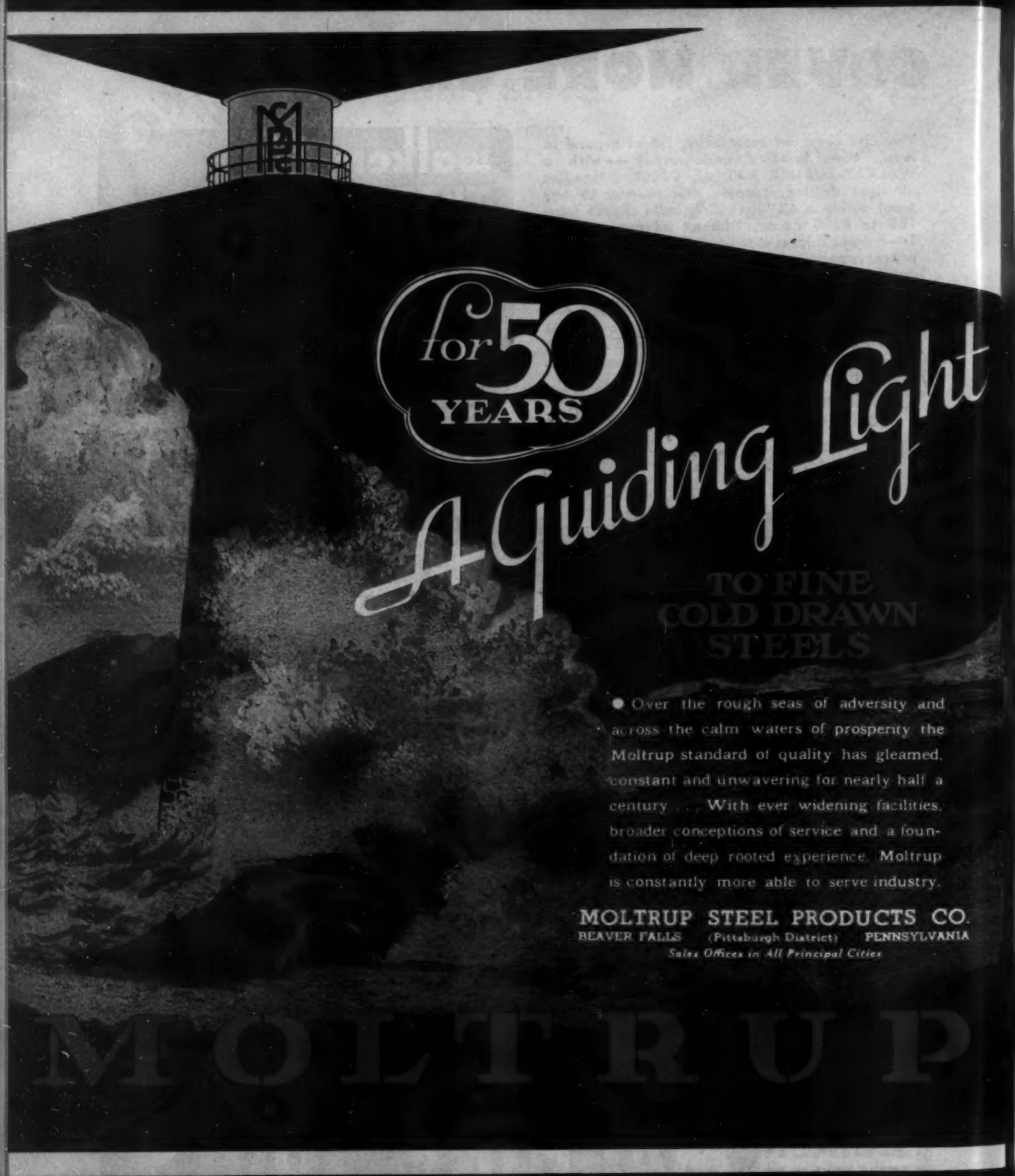
Small diameter holes (up to ½"), a large area to be covered and a heavy, cumbersome jig makes an ideal set-up for a WALKER-TURNER RADIAL DRILL.

(Photo courtesy Lewyt Metal Products)

walker-Turner COMPANY, INC. PLAINFIELD, N.J. U.S.A.

MACHINE TOOLS

DRILL PRESSES — HAND AND POWER FEED • RADIAL DRILLS
METAL-CUTTING BAND SAWS • POLISHING LATHES • FLEXIBLE SHAFT MACHINES
RADIAL CUT-OFF MACHINES FOR METAL • MOTORS • BELT & DISC SURFACERS


for 50 YEARS
A Guiding Light
TO FINE COLD DRAWN STEELS
● Over the rough seas of adversity and across the calm waters of prosperity the Moltrup standard of quality has gleamed, constant and unwavering for nearly half a century . . . With ever widening facilities, broader conceptions of service and a foundation of deep rooted experience, Moltrup is constantly more able to serve industry.
MOLTRUP STEEL PRODUCTS CO.
BEAVER FALLS (Pittsburgh District) PENNSYLVANIA
Sales Offices in All Principal Cities
MOLTRUP

Advertisement JANUARY, 1943

COPPER ALLOY BULLETIN

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared Each Month by the Bridgeport Brass Co. "Bridgeport" *Headquarters for BRASS, BRONZE and COPPER*

Fabricating Costs Reduced by Proper Metal Selection

Careful thought should be given to the selection of brass, bronze and copper for a particular job, since the choice of a suitable metal or alloy may appreciably decrease the cost of both labor and materials.

The proper sheet, rod, wire or tube for any application can be selected only after all the requirements of the complete job have been considered. The metal chosen must provide the characteristics necessary to the finished product and it must permit carrying out the finishing and forming operations at minimum production cost. Bridgeport's experienced engineering and metallurgical staffs are often able to suggest to the fabricator the metal or alloy which best suits his needs.

Another important factor to be considered is an assurance that the characteristics of the material ordered will be duplicated on subsequent orders. Expert metallurgical supervision and the use of electric furnaces permits Bridgeport to supply materials of uniform characteristics on order after order.

Your inquiries are invited concerning any problems on the selection or working of copper alloys.

Memos on Brass—No. 34

One of the leading factors in the industrial utility of brass is its unusually high ductility. This quality is determined by the type of crystalline structure. The so-called alpha brasses, those containing more than about 63% copper, owe their exceptional ductility to the ability of the crystals to flow or stretch under load to a remarkable degree.

Modern miniature casting furnaces like this are enabling Bridgeport laboratory technicians to steal a quick march in the race against time to turn out war supplies. With them, they can cast alloys for processing and testing more quickly than in a regular mill furnace and without tying up equipment needed for war output. Further, these miniature furnaces permit Bridgeport to steal a march on the future by making it possible to carry on the development of new alloys for after-the-war use when they will be needed in vast quantities.

Versatile Properties, Workability Of Duronze Alloys Serve Wartime Needs

Silicon Bronze Alloys Combine High Strength with Light Weight in Exceptionally Corrosion-Resistant Parts

The important role of dependable, efficient, adaptable metals and alloys is being emphasized forcibly today by the exacting requirements of the nation's war production. Coupled with this, there has been the increasing appreciation on the part of engineers of the importance of such materials both in the construction of many articles of new design and application that are being developed and in the improvement of old ones.

All too often have rust and intrinsic weakness caused the premature failure of otherwise correctly designed products. Today's higher standards of strength and corrosion resistance are being served by this family of high copper silicon alloys developed by Bridgeport. Known respectively as Duronze I, II, III, IV and V, and containing small quantities of other metals, including aluminum and tin, these alloys represent an outstanding development in metallurgy.

Strength, Resistance

Each of the Duronze alloys is characterized by higher strength and greater corrosion and wear resistance than brass or copper; by high fatigue resistance and by their non-magnetic properties. With the exception of Duronze IV, which is supplied only in tube form for condensers operating under severe service and for the process industries such as conveying brine solutions, the Duronzes can be adapted to most fabricating methods and made into various items which meet modern engineering specifications. This fact is opening up new applications in the manufacture of parts requiring higher tensile strength and greater corrosion resistance. To meet these varying applications, each alloy differs to some degree in such properties as workability, machinability and hardness, etc. Because of this versatility, it is frequently possible for the fabricator to select a specific Duronze alloy on the basis of the manufacturing equipment he has available for making such items as electrical connectors, marine hardware, bolts and nuts.

In the table below are shown the particular forms in which the various Duronze alloys are supplied to manufacturers...hot rolled sheet, cold rolled strip, rod sheet, wire, seamless tubing and ingots for remelting.

It will also be seen from the table below that the fabricator may cold head and roll thread bolts from Duronze I or V; hot forge them from Duronze II; hot forge them or form them on screw machines from Duronze III. Parts for electrical connectors may be cold forged from Duronze I or V; hot forged or sand cast from Duronze II or III.

Most sizes of Duronze bolts made by cold heading average over 100,000 pounds per square inch in tensile strength. Hot forgings made from Duronze III have the remarkably high tensile strength of about 85,000 pounds per square inch, while rod for screw machine items averages about 95,000 pounds per square inch.

Duronze II in the form of sheets is ideal for the manufacture of small tanks, ducts for air conditioning, or equipment for sewage disposal which can be made by either gas or electric arc welding. Hard rolled Duronze II strip is recommended for applications requiring fine spring qualities and often replaces phosphor bronze spring metal with a saving in war essential tin.

Machining Characteristics

Duronze III offers outstanding advantages for automatic screw machine products. It is free machining and can be cut from 50 to 70% as fast as free cutting brass rod, using the same tools that are suitable for brass. Further, it is almost twice as strong as brass and presents a harder surface. It is excellent in combination with steel for the manufac-

(Continued on page 2, column 2)

Duronze Alloy Number	FORMS AVAILABLE						FABRICATION PROCESSES				
	Hot Rolled Sheet	Cold Rolled Strip	Rod	Wire	Tube	Ingot	Cold Working	Hot Forging	Sand Casting	Automatic Screw Machine	Welding
I		√	√	√			√				
II	√	√	√	√	√	√		√	√		√
III			√			√		√	√	√	
V			√	√	√		√				

COPPER ALLOY BULLETIN

CAUSES OF CORROSION

ELECTROCHEMICAL THEORY OF CORROSION

This article, the first of two on the types of films which accelerate corrosion, is the third in a series of discussions by C. L. Bulow, research chemist at Bridgeport Brass Company, on some of the fundamentals of corrosions as applied to numerous common failures occurring in service. In the last two issues of the Copper Alloy Bulletin, *which are available on request, Mr. Bulow discussed corrosion rates.*

The nature and distribution of the corrosion product formed on the metal surface has a tremendous influence on the rate of corrosion. The corrosion product may be a solid impermeable or a permeable film with physical and chemical properties which are different from the metal being corroded.

Two Types of Films

The corrosion films which form on metals may be considered as belonging to two classes: the visible non-protective films and the invisible protective films. It must be remembered that there are numerous films which have characteristics between these two extremes.

The visible films, which are insoluble in the corroding medium, usually have the following characteristics:

(1) They are permeable to water (they permit the flow of a fluid through them).

(2) They are sufficiently dense to impede the flow of fresh corrodent to the metal surface (this may also slow up the rate of corrosion).

(3) They are non-uniform or discontinuous, thus permitting the corrodent to come in contact with metal in certain areas and partially screen the metal in others.

(4) The corrosion may be increased in certain screened areas by the formation of concentration cells.

(5) The metal under the partially permeable film usually becomes pitted (anodic area) or attacked by localized corrosion.

(6) The exposed metal or those areas covered with thinner films are only slightly corroded (cathodic area).

(7) The continued accumulation of corrosion products of the same type helps to produce deeper pits or to enlarge the area being corroded.

(The discussion of this phase of corrosion will be concluded next month in this column.)

Duronze Alloys

(Continued from page 1, column 3)

ture of gears, pinions or worms; for sliding or rolling parts to reduce wear; and for airplane fittings where fatigue failure must be eliminated.

For applications involving very severe corrosive conditions it is frequently desirable to determine by test under actual service conditions which of the Duronze alloys is most suitable.

More complete details on the physical properties and applications of the Duronze alloys are covered in the new Duronze Manual which Bridgeport recently published. Copies will gladly be sent free upon request. The Bridgeport Research Laboratory is at your service to answer specific questions concerning your metal problems.

Cold Heading Process Adapted to Small Parts

Increased use is being made of the cold heading process for the formation of bolts, screws, compression nuts and miscellaneous small parts because it produces extremely strong pieces without the necessity of expensive operations.

Brass and certain high copper silicon alloys have been found especially suitable for cold heading operations because of their strength and corrosion resistance. Both are malleable prior to working and acquire high strength without brittleness in the forming process.

NEW DEVELOPMENTS

A low-tin babbitt has been developed for general applications under fair operating conditions and in cases where the bearing will be carefully fitted and lubricated. Tensile strength is described as 8,200 pounds p.s.i. with compressive strength at 17,500 pounds p.s.i. Elongation is said to be 1.2 per cent in two inches and hardness 25 on the Brinell scale. The babbitt is claimed to pour at 625 to 675° F. **(No. 400)**

A sealing material has been introduced for application on wood and concerte to protect against attack by oil or gasoline and to prevent infiltration of such liquids. The maker says it can also be employed as a protective coating on steel. The material is applied like paint and is said to dry hard in two to three hours. It is described as inert to attack by petroleum products, manufactured solvents, organic oils, and fatty acids. **(No. 401)**

A tool bit is announced for application in steel after it has been hardened and in alloys of copper, aluminum and steel having characteristics of toughness and hardness which have made machining impractical without initial softening or have confined finishing operations to grinding or flame cutting. The new bit applies in standard machine tools. **(No. 402)**

A granular cleaning material has been developed for solution in water and application on a concrete floor to dissolve accumulated grease and permit its removal. The solution is mopped on the floor, allowed to stand for 3 to 15 minutes, then mopped or brushed up. The solution is described as mildly chemical, non-fuming and non-toxic. **(No. 403)**

A vise designed to hold large work is offered. A movable jaw rides square ways, carries a removable nut to engage the operating screw. A stationary jaw is integral with the body casting and has a cleanout opening. The vise body swivels on a base which carries degree graduations for movement through a complete circle. The unit is made in three sizes with 7 to 13 in. maximum opening between the jaws. Jaw depth is 1¾ to 3 inches. **(No. 404)**

A pneumatic rivet-squeezing tool has been put on the market, featuring parallel movement between the jaws which assist the tool in holding the rivet while it is being closed and in forming uniform heads. Pressure is applied at a control valve which admits air and releases it in a cylinder. The tool weighs 5½ pounds, measures 12¼ inches in length. It has a working gap of 15/16 inches and opens to 1½ inches. **(No. 405)**

A non-slip floor mat is offered, consisting of wood strips with an abrasive top surface. Oak strips are assembled with dowels, and alundum abrasive aggregate in a medium grain size bonded to the top surface. Such surface is claimed not to be affected by alcohol, gasoline, creosote, water, petroleum oil, solvents nor mediumly severe temperature extremes. **(No. 406)**

This column lists items manufactured or developed by many different sources. Further information on any of them may be obtained by writing Bridgeport Brass Company, which will gladly refer readers to the manufacturer or other source.

PRODUCTS OF THE BRIDGEPORT BRASS COMPANY

Executive Offices: BRIDGEPORT, CONN.—Branch Offices and Warehouses in Principal Cities

SHEETS, ROLLS, STRIPS—*Brass, bronze, copper, Duronze,* for stamping, deep drawing, forming and spinning.

CONDENSER, HEAT EXCHANGER, SUGAR TUBES—For steam surface condensers, heat exchangers, oil refineries, and process industries.

*Trade-name.

PHONO-ELECTRIC* ALLOYS—High-strength bronze trolley, messenger wire and cable.

WELDING ROD—For repairing cast iron and steel, fabricating silicon bronze tanks.

LEDRITE* ROD—For making automatic screw machine products.

"Bridgeport" BRASS

Established 1865

COPPER WATER TUBE—For plumbing, heating, underground piping.

DURONZE ALLOYS—High-strength silicon bronzes for corrosion-resistant connectors, marine hardware; *hot rolled sheets* for tanks, boilers, heaters, flues, ducts, flashings.

BRASS, BRONZE, DURONZE WIRE—For cap and machine screws, wood screws, rivets, bolts, nuts.

FABRICATING SERVICE DEPT.—Engineering staff, special equipment for making parts or complete items.

BRASS AND COPPER PIPE—"Plumrite"* for plumbing, underground and industrial services.

Note: Bridgeport products are supplied in accordance with existing priority regulations.

BRIDGEPORT BRASS

A page from Experience

TO HELP YOU NOW AND IN THE FUTURE

CMP PRECISION COLD ROLLED STRIP STEEL SPEEDS PRODUCTION AND LOWERS COST IN WIDE VARIATION OF REQUIREMENTS . . . . . .

The wide range of physical properties available in CMP strip makes it adaptable for many products where speed and cost are vital factors. Wartime requirements for light gauge metals have particularly proven the broad potentialities of CMP precision strip—it is successfully serving in many cases where precedent ruled it neither feasible nor practical. Result—increased essential production, faster fabrication and lowered cost. Better check on CMP strip—you will want the interesting facts for post-war product plans too.

THESE ADVANTAGES HAVE PROVEN OF IMPORTANT VALUE TO MANY VITAL WAR INDUSTRIES . . .

CONTROLLED UNIFORMITY

Consistent accuracy and uniformity are certain with CMP strip. Vigilant quard and precise control methods assure duplication of all desired properties in coil after coil—you get steel precision fitted to the job.

COILS UP TO 300 LBS. PER INCH OF WIDTH

Where automatic machines are utilized, work delays can be minimized. Normally CMP strip can be supplied in coils up to 300 lbs. per inch of width—keeps presses productive for long periods without interruptions—a real help for high speed production.

REPLACING NON-FERROUS METALS

Many new and important applications of CMP strip involved the change from light gauge non-ferrous metals. These cases were successfully accomplished by meeting essential physical characteristics of metals formerly used.

MORE FEET PER POUND

You get the most out of each vital ton with CMP strip. It is the CMP custom of rolling to exceptionally close tolerances, whether specified or not, that provides maximum feet per pound and thus more finished parts per ton—a CMP advantageous "extra."

THE COLD METAL PRODUCTS CO.

SUBSIDIARY OF THE COLD METAL PROCESS COMPANY

YOUNGSTOWN, OHIO

CMP STRIP STEEL

PRECISION COLD ROLLED

for

MAXIMUM PRODUCTION PER TON

A New and Better Cutting Oil for

NOT for aluminum alloys alone—not for magnesium alloys alone, but for *both* . . . made especially for the high-speed machining of either aluminum or magnesium alloys. Note well its name... *Texaco "ALMAG" Cutting Oil.*

Texaco "Almag" properly cools and lubricates the cutting tools, extending their life, improving surface finish, assuring increased cutting speeds and greater output. *"Almag"* is transparent, and non-irritating to the skin.

The outstanding performance that has made Texaco preferred in the fields listed in the panel has made it preferred by prominent users in the metal-cutting field.

Texaco users enjoy many benefits that can also be yours. A Texaco Engineer specializing in cutting coolants will gladly cooperate . . . just phone the nearest of more than 2300 Texaco distributing points in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York, N. Y.

The high output of your Bullard Mult-Au-Matics machining aluminum or magnesium alloys can be raised still further by using *Texaco Almag Cutting Oil.*

Increased tool-life
Better finish
Less fogging
No offensive odor
Non-irritating

THEY PREFER TEXACO

★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

★ More locomotives and cars in the U. S. are lubricated with Texaco than with any other brand.

★ More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

★ More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.

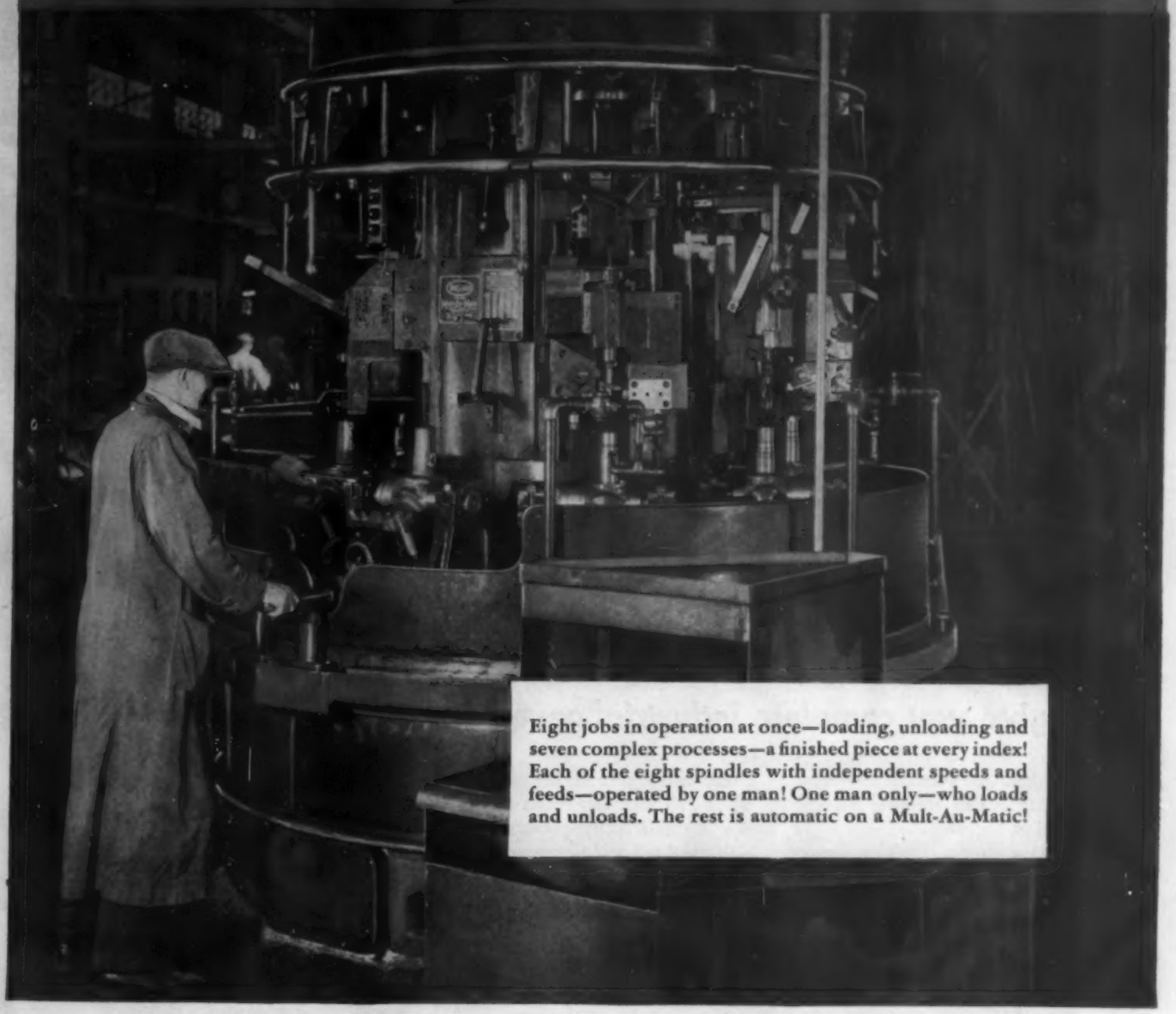
TEXACO

TEXACO

TUNE IN FRED ALLEN EVERY SUNDAY NIGHT—CBS

ALuminum-MAGnesium

ALLOYS



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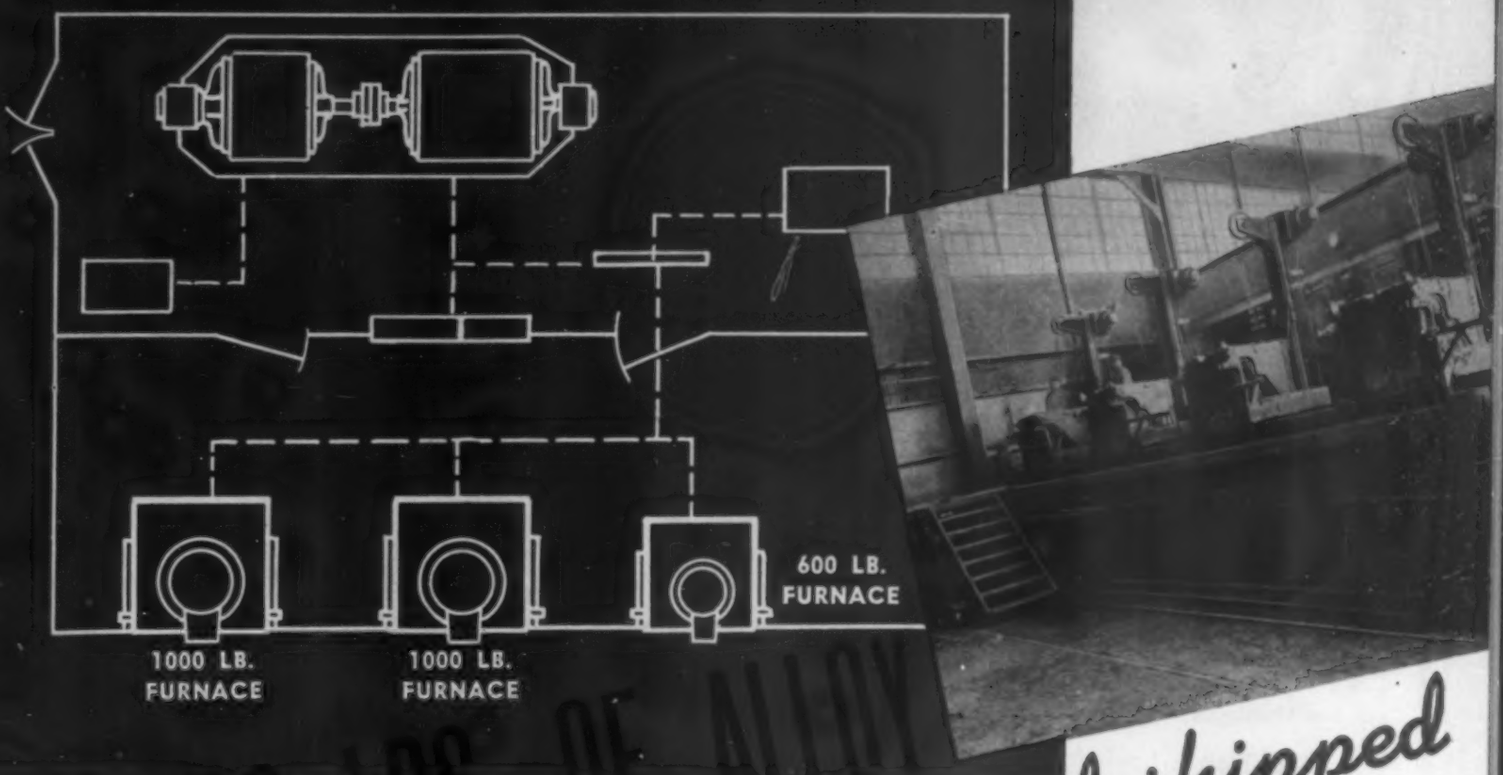

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The same equipment that insures volume and speed now can be converted to produce smaller melts at low cost later on. Or it can be used for heating, brazing and a dozen other applications.

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In these days of tailor-made analyses, of quantities ranging from 10 lbs. to 10 tons, of necessity for speed with accuracy, high frequency melting equipment is "worth its weight in gold," as one user puts it.

49

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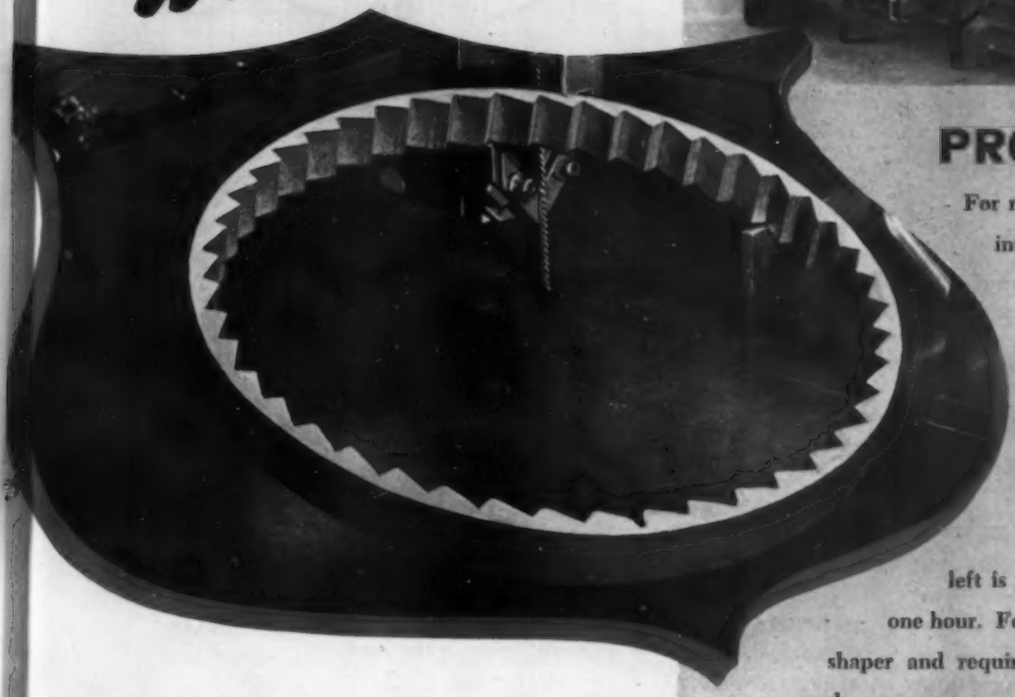

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For regular run-of-shop jobs, the DoAll handles internal and external cutting with speed and economy. Accurately follows a hairline layout on any metal or alloy—blocks a foot thick, bars, flats, sheets or tubing—and no further machining is necessary

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3

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5

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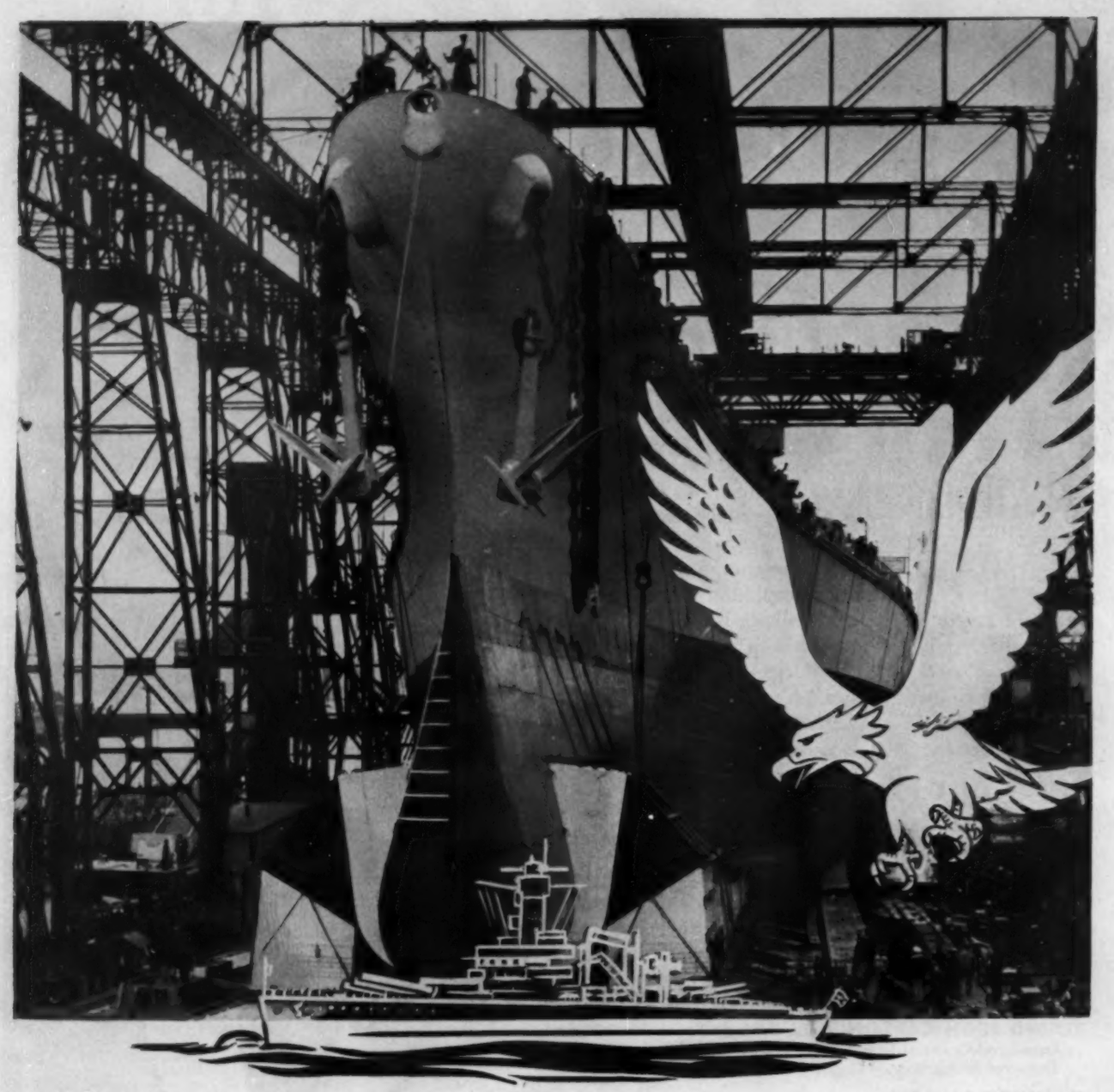

THE SCORE TO DATE.....

To date, the number of Axis battlecraft sunk or damaged greatly exceeds our casualties . . . the ratio is heavily in our favor . . . though they had a head start on us.

Yes, the valiant men of the U.S. Navy are outfighting the enemy . . . and, of utmost significance to the final outcome, the men in our shipyards are outbuilding him!

Sorry, we can't give figures. But, draw your own conclusions—

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WORTH

WORTH STEEL COMPANY

CLAYMONT, DELAWARE

PUTTING a "knockout punch" into Axis-blasting projectiles—loading high-explosive shells as well as armor-piercing bombs—these are the vital war duties of a group of presses built by Watson-Stillman.

At this time we cannot say how many there are, or where they are. But it's no military secret that production schedules for these presses will exceed the specification speeds.

This ammunition-serving equipment takes its place beside many other Watson-Stillman hydraulic presses which are packing a war wallop—those which are straightening gun barrels—those which are bending the keels of tomorrow's transports—those which are producing aircraft parts, powder, and shell forging.

Elsewhere throughout the wartime metal industries, you will find scores of other W-S units—many kinds of presses, high-pressure pumps, jacks, fittings and valves for hydraulic service.

Write for General Bulletin 110A.
The Watson-Stillman Company
Roselle, New Jersey

Shell loading
Bomb loading
Two war jobs for W-S presses

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Engineers and Manufacturers of Hydraulic Machinery and Equipment—Hydraulic Presses, Pumps and Jacks, Forged Steel Valves and Fittings

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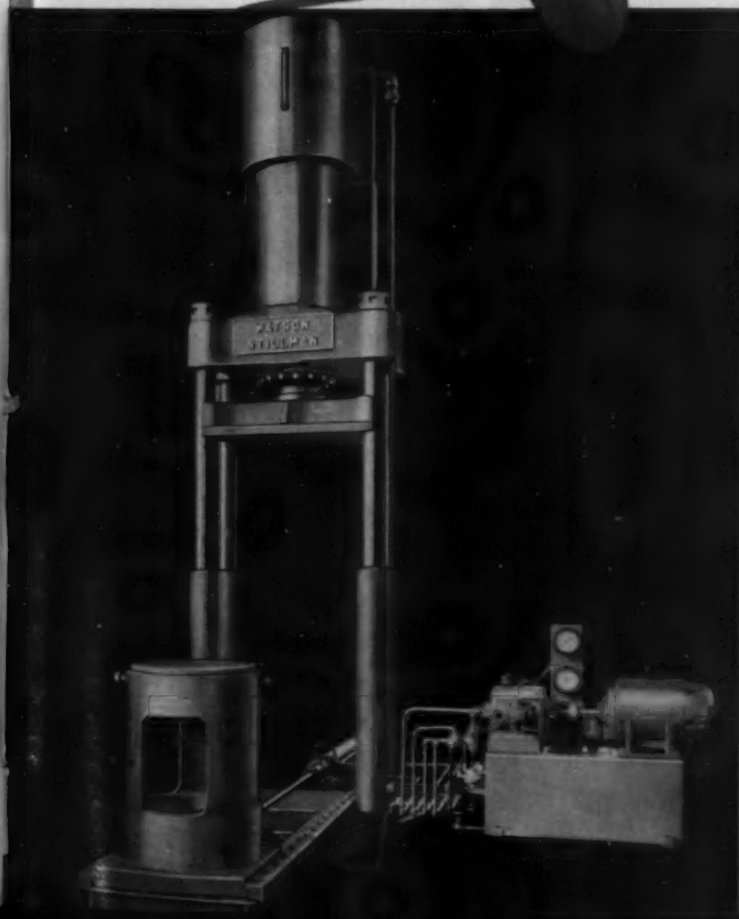

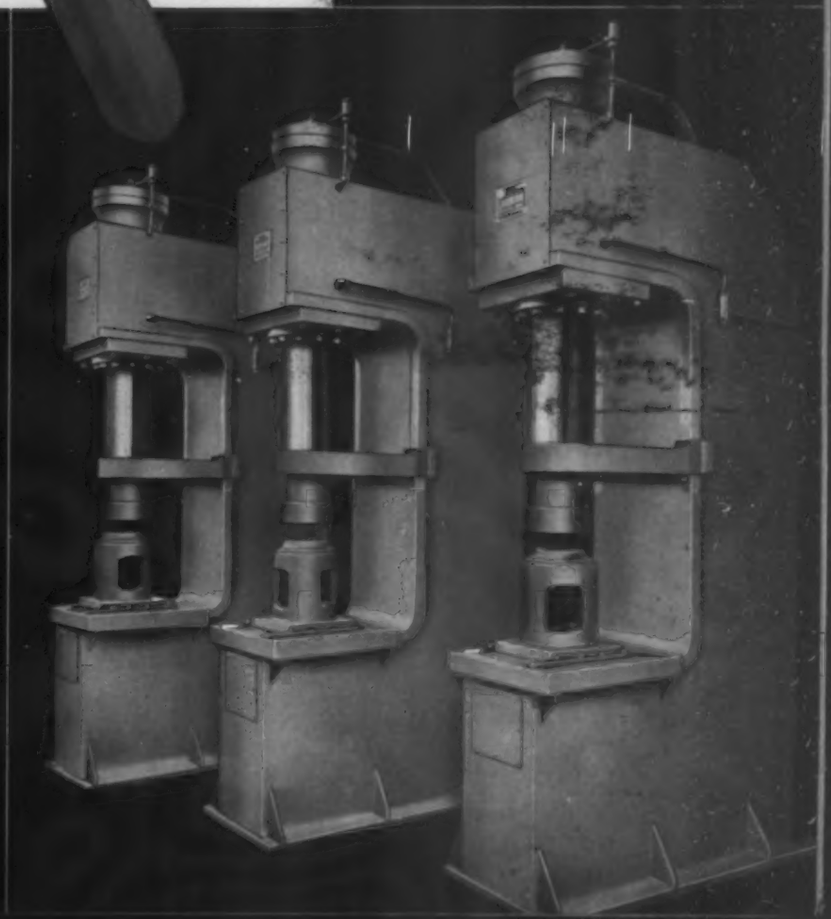

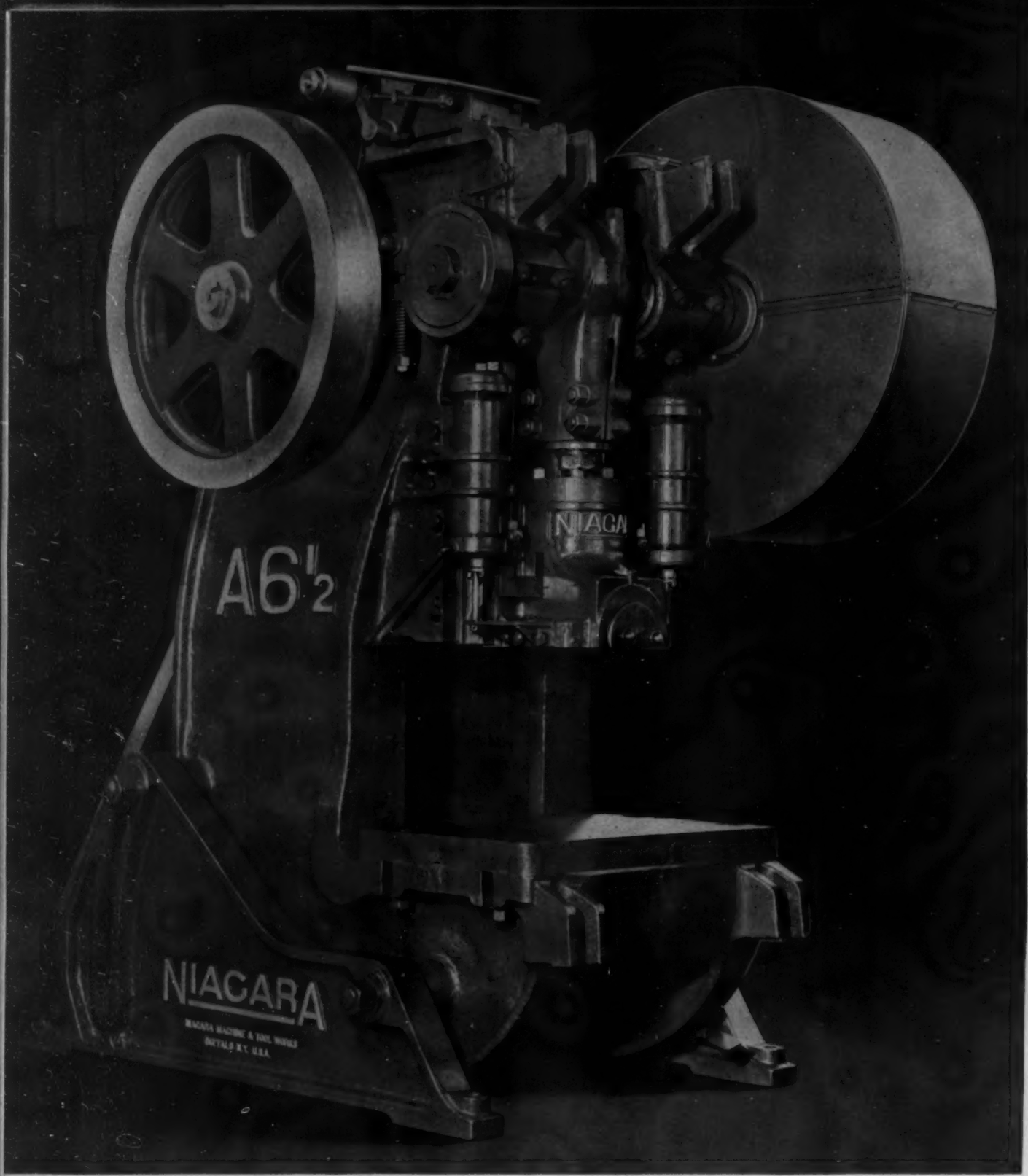

SERVING WAR PLANTS

Niagara Presses and Shears, some of which are illustrated on these two pages, are increasing output of fighting material. Just one example of their many advanced engineering features is the instant-acting Niagara 14-point engagement sleeve clutch which increases both the efficiency of the press and the operator, and results in—

MORE PRODUCTION PER MAN-HOUR

NIAGARA MACHINE & TOOL WORKS

General Offices and Works: 637-697 Northland Avenue, Buffalo, N. Y., U. S. A.

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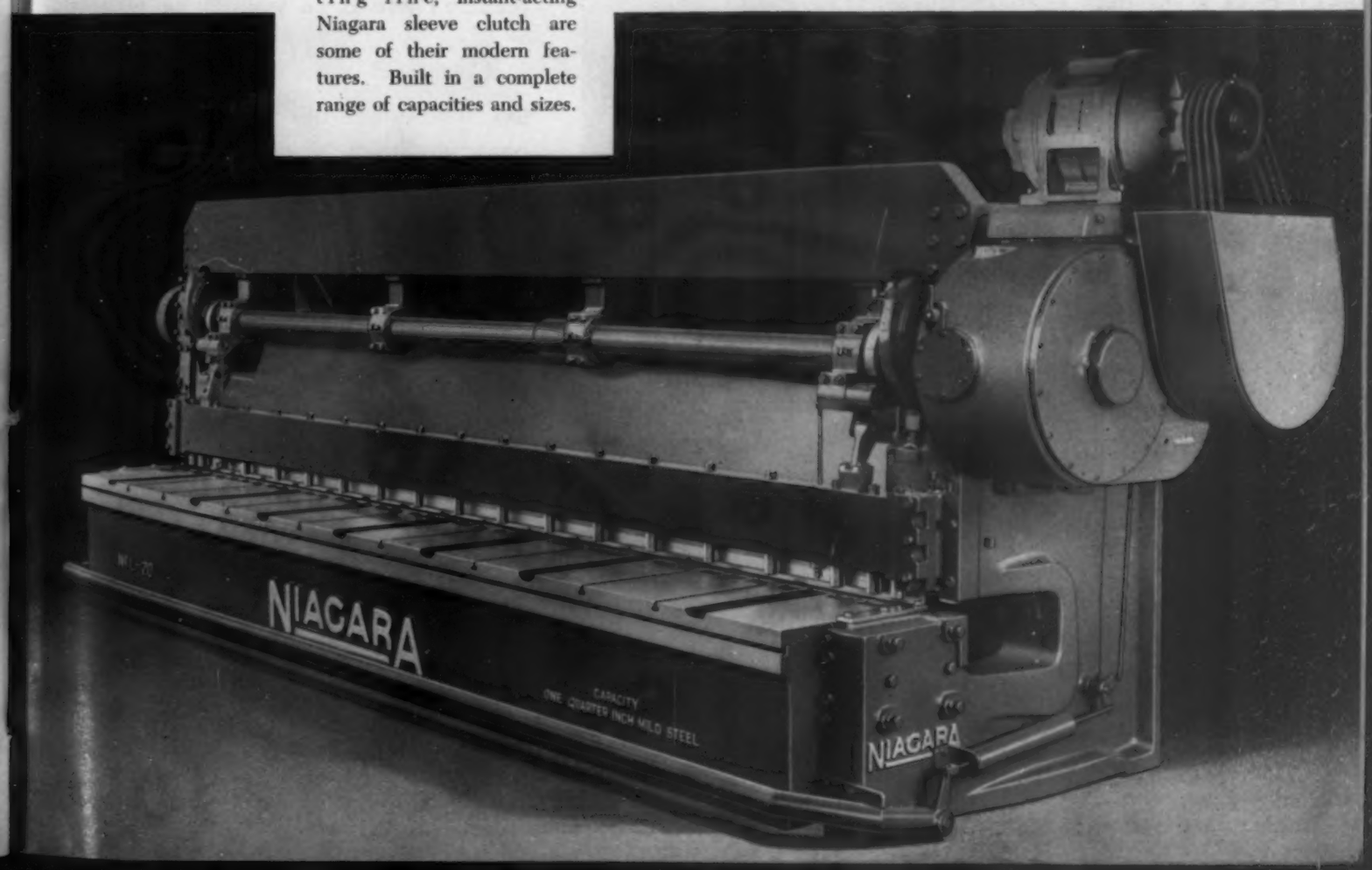
More production per man-hour is being obtained in war plants using Niagara Power Squaring Shears. Convenient operation, quick, accurate setting of ball bearing self-measuring parallel back gages, full visibility of cutting line, instant-acting Niagara sleeve clutch are some of their modern features. Built in a complete range of capacities and sizes.



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EASTON ROCKER DUMP TRAILER SIMILAR UNITS ARE SERVING AIRCRAFT AND OTHER WAR INDUSTRIES ALSO ROCKER DUMP CARS

Keep moving WITH EASTON

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★ To help conserve critical materials EASTON has limited production of electric trucks to six standard government-approved models: the low-lift, the tier-lift, the low-platform and the high-platform trucks of 4,000 pounds capacity; and the 6,000 pound low-lifts and tier-lifts. Let EASTON engineers demonstrate how one of these six basic models can be adapted to your requirements.

INDUSTRIAL CARS AND TRAILERS

★ EASTON cars and trailers are used in almost every industrial haulage operation — handling raw materials at their source, moving parts and finished products through production processes, speeding up work at distribution centers. Capacities range from 4,000 pounds to 250 tons. Every EASTON car and trailer is a Victory Model, using fewer critical materials wherever possible and built from the ground up for "E-Plant" efficiency.

ENGINEERING COUNSEL

★ EASTON specializes in engineered material handling equipment designed to meet specific operating conditions. For new ideas in material handling, for repairs, or for replacements write to: Engineering Counsel, Easton Car & Construction Company, Easton, Pennsylvania.

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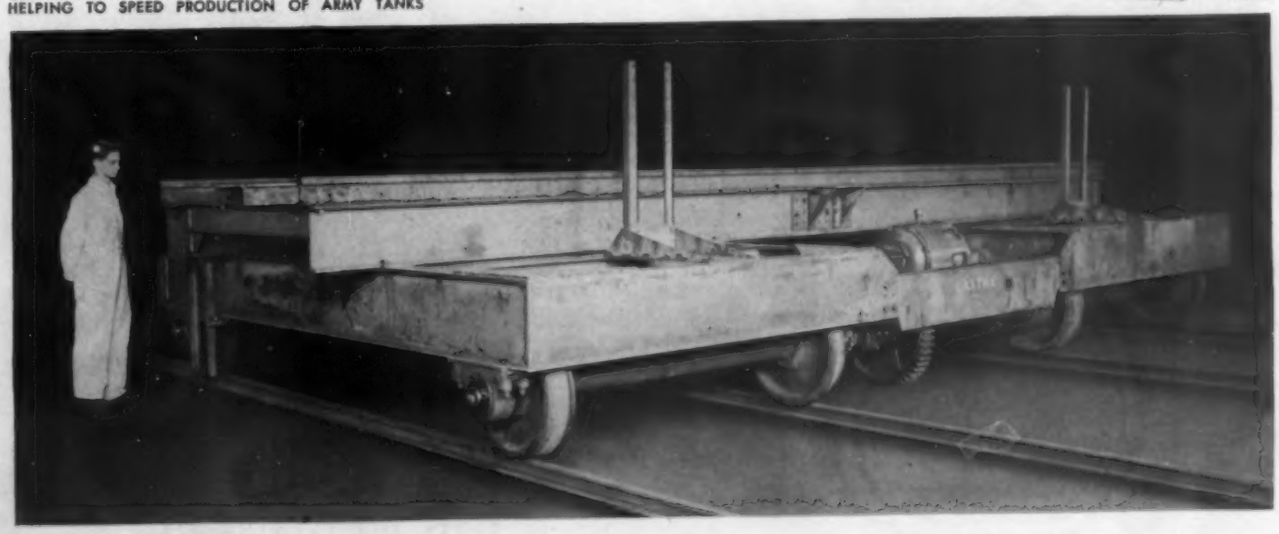
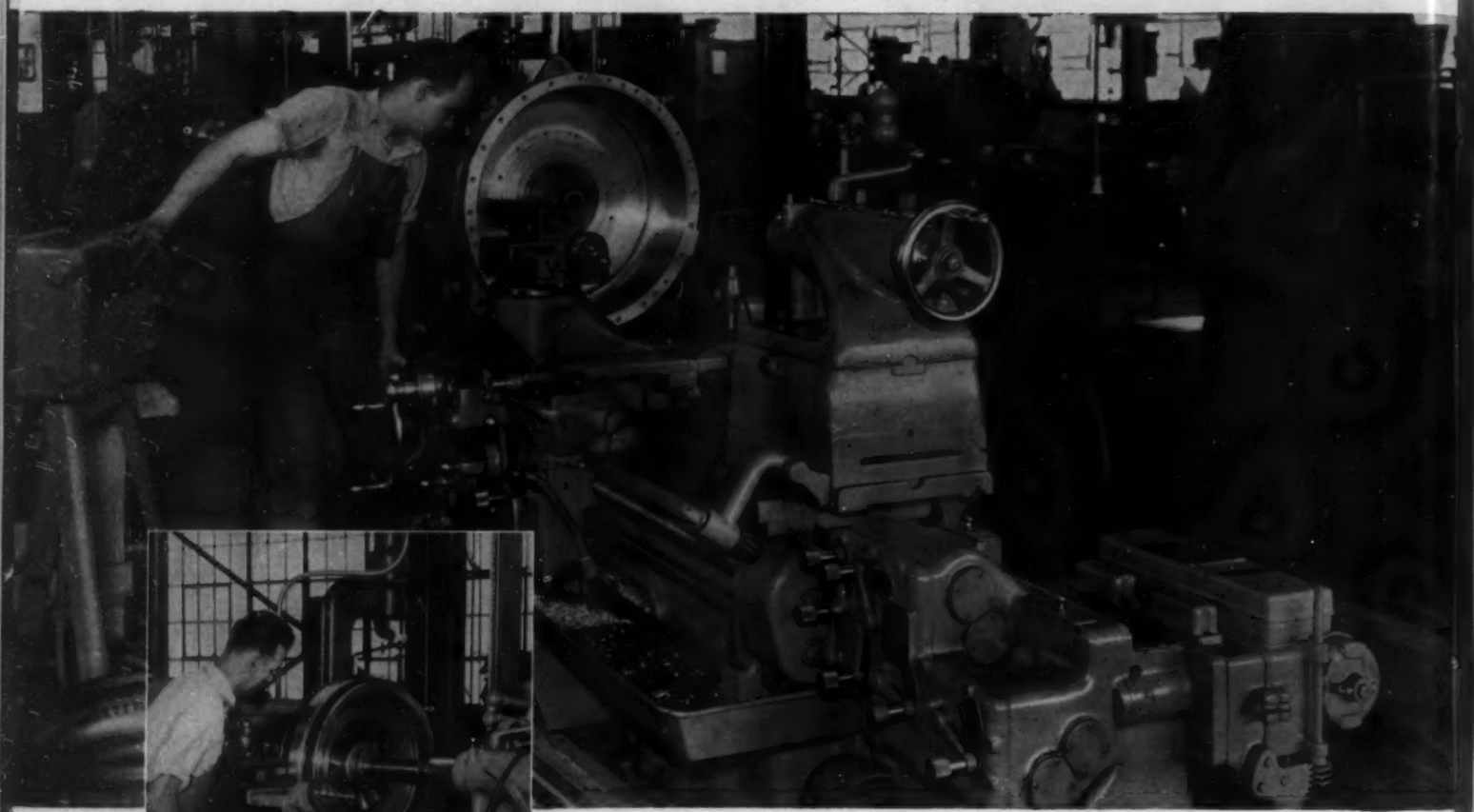
BELOW: ONE OF AN ORDER OF SIX EASTON DOUBLE-UNIT MOTOR-DRIVEN TRANSFER CARS WHICH ARE HELPING TO SPEED PRODUCTION OF ARMY TANKS



Careful job analysis saves time, material and money...

Keeps production on schedule



Large photograph shows the use of Monarch lathe with automatic Keller control, permitting greatly increased production of this aluminum housing. Inset illustrates turning of rotors, with manual control.

This plant, converted to war work, had a new job to do—building fluid drives.

The large diameters of aluminum main housings and rotors suggested 36" lathes, with Monarch-Keller controls for finishing the contour surfaces. Careful job analysis showed the duty requirements could readily be met by a much smaller lathe, if raised to provide 36½" swing. Because of the lightness of the work, small size controls were deemed adequate.

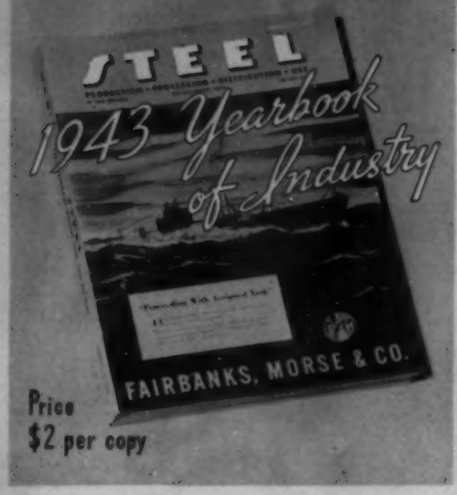
Monarch 22" Model M Lathes were ordered and put to work months before the larger lathes could have been shipped. Their lighter weight saved precious critical materials. Many million machine gun bullets can be bought with the $58,000 saved in first cost. Best of all, production is being kept on schedule.

Such applications of shop knowledge are the everyday work of Monarch field engineers. If they can help you in your War effort, they are at your service.

THE MONARCH MACHINE TOOL COMPANY···SIDNEY·OHIO

MONARCH LATHES

COVER THE TURNING FIELD



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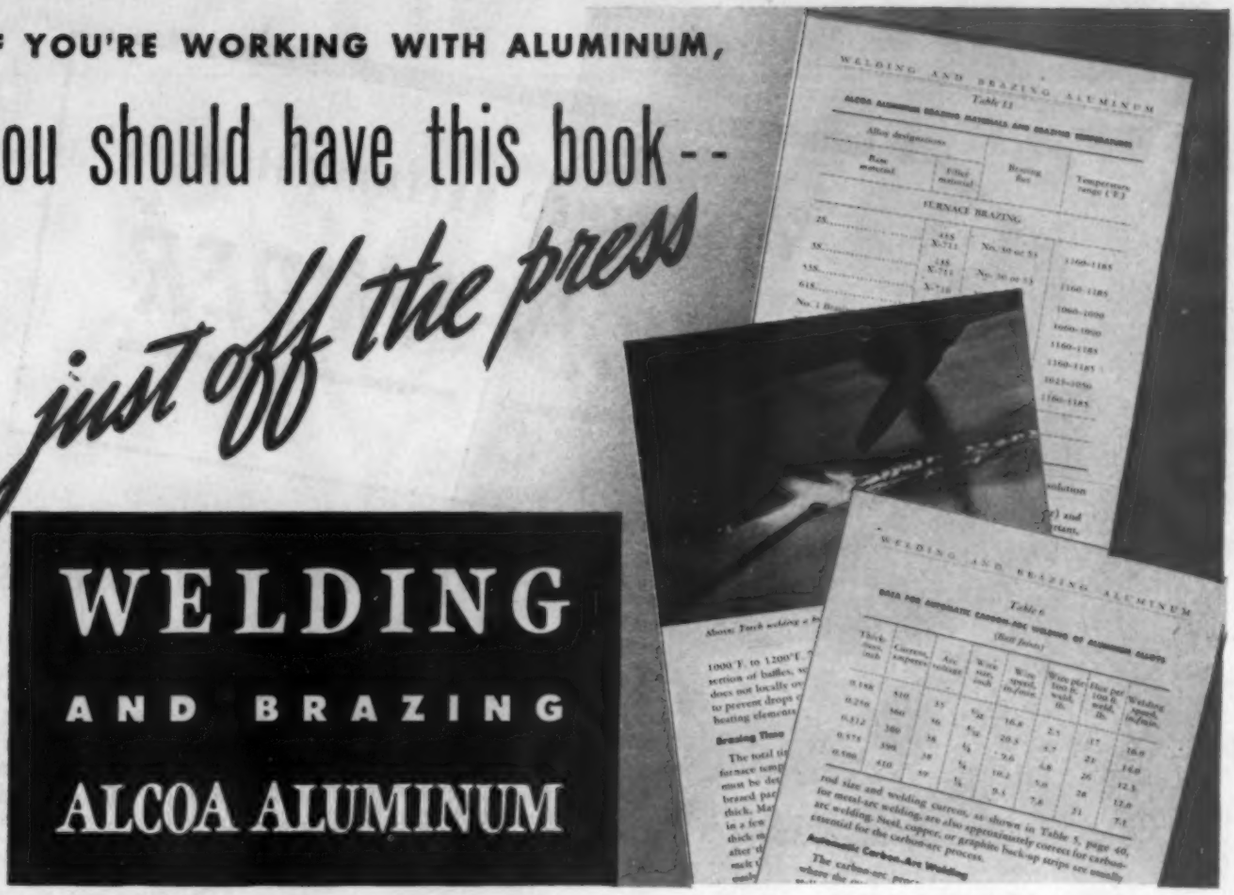

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STEEL
January 4, 1943

The World of Tomorrow

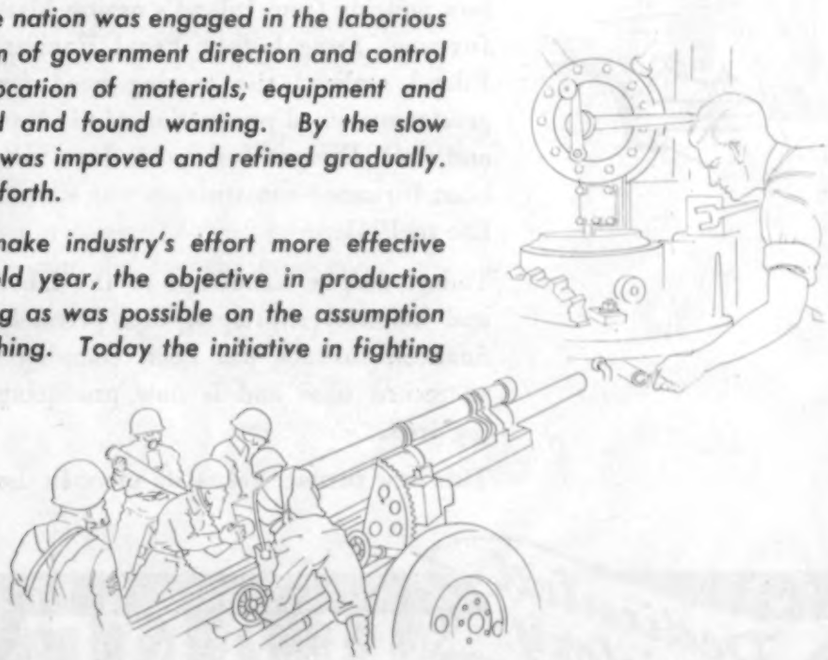
For more than a year American industry has been engrossed in the task of preparing for and executing the largest production job the world has ever witnessed. Looking back over 1942, it is apparent that industry has done its work well, in spite of great difficulties.

In the course of 12 swiftly passing months, industry has converted a large portion of its capacity to war work, has expanded plant and equipment to a marked degree and has hit a good stride in large-scale production of munitions and other essentials of war. No industrial nation, including the United States, has ever accomplished so much in such a short time.

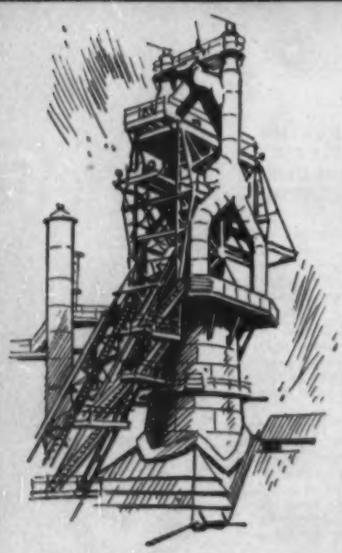
The challenge of 1943 will present no radically new problems. Industry will be called upon to produce war goods in substantially greater volume than in 1942. This it should be able to do readily, because more of the effort expended in the new year will be effective in production. Last year a large portion of industry's attention and energy was given over to conversion, expansion and adjustment to war conditions. Most of this spade work has been completed.

Industry's effort should be more effective in 1943 for another reason. Throughout much of the past year, the nation was engaged in the laborious procedure of trying to evolve a system of government direction and control of procurement, production and allocation of materials, equipment and supplies. Plan after plan was tried and found wanting. By the slow process of trial and error, the system was improved and refined gradually. It will function more smoothly henceforth.

Still another important factor will make industry's effort more effective in 1943. Throughout most of the old year, the objective in production was to turn out as much of everything as was possible on the assumption that we had to be prepared for anything. Today the initiative in fighting



Dedicating Inland's newest blast furnace. Left to right, front row: J. H. Walsh, vice president; Mrs. Henry Straus, daughter of the late P. D. Block, an Inland founder; Wilfred Sykes, president; and, E. L. Ryerson, chairman of the board.



Inland Lights New Blast Furnace

First Constructed in Midwest Since Start of War

Molten pig iron—1,200 tons a day—is now pouring from Inland's newest blast furnace. Long before Pearl Harbor, Inland realized the coming need for greater sustained production of pig iron and steel. Designs were made for a new blast furnace—construction was started late in 1941.

Today, despite handicaps of the labor and material shortages, this privately financed furnace has been completed in record time and is now producing pig iron.

This new furnace takes its place in the war program, not only to augment production of pig iron, but also to safeguard Inland's needed iron supply in the event that other furnaces, long pressed to capacity, must be taken out of service for needed repairs.

Completion of this new blast furnace is the second major project undertaken and put into operation by Inland since war began. Other projects—including two additional blast furnaces for the Government—all planned to increase tonnage for America's war effort—are rapidly nearing completion.

Dedicated to Victory

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(CONTINUED)

has swung to our side. To a greater degree than heretofore we can plan our campaigns and estimate our needs. In 1943 we should be able to key production more closely to the demands of the fighting forces.

At the same time, while industry will be intent upon pushing production to the limit and in striving in every way to help the men at the front to defeat the enemy at the earliest possible moment, there will be a steadily increasing interest in the conditions of peace and in the kind of world in which we will live during the postwar period.

No power on earth is strong enough to prevent persons in all walks of life from thinking and worrying about the world of tomorrow. In the months to come they will be more and more insistent upon knowing what they are fighting for. They will want to know that competent leaders are planning for the right kind of a peace and for the right kind of a peacetime economy. In short, they will want to see blueprints more specific than the Atlantic charter or Vice President Wallace's quart of milk a day.

The more the questions of peace and of the future peacetime way of life are discussed, the better everybody will be prepared for eventualities when the war has been won. Full encouragement should be given for the free expression of opinion on these matters.

Typical of what can be done in this direction is the statement issued recently by 120 leading British industrialists. In it they outlined a program for a healthy postwar economy, in which industry's threefold responsibility to the public, labor and investors was set forth clearly and frankly.

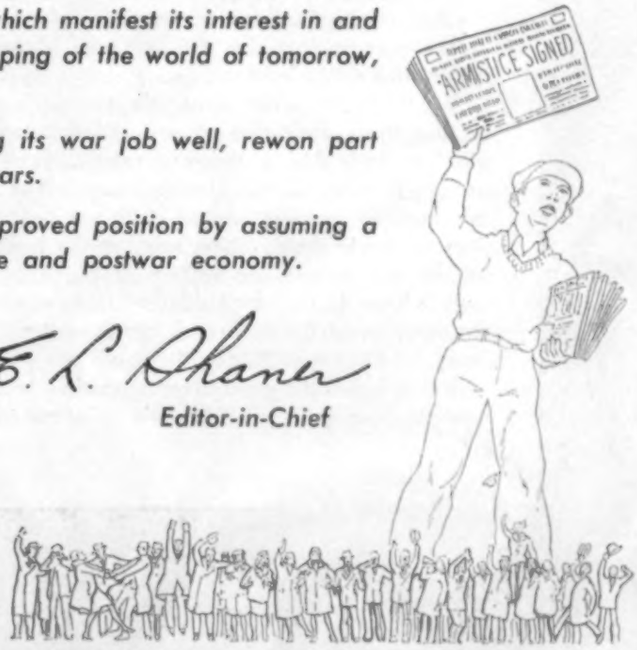
Pronouncements of this kind by industry, which manifest its interest in and acknowledge its responsibilities for the shaping of the world of tomorrow, are timely and constructive.

During 1942 American industry, by doing its war job well, rewon part of the public esteem it lost in previous years.

In 1943 and beyond, it can clinch this improved position by assuming a constructive role in the problems of peace and postwar economy.

E. L. Shaner

Editor-in-Chief



Prescription for 1943: REMOVE IN

WHICH IMPAIR EFFECTIVENESS O

A YEAR ago the editors of STEEL scanned carefully the editorial material then being edited for the Jan. 5, 1942, "Yearbook of Industry" issue and concluded that as far as the United States was concerned the war—in which we had been engaged as a belligerent for less than a month—would prove to be a war of "M's." Throughout that issue, the major emphasis in editorial content was placed upon these "M" resources of the nation—men, money, materials, machines and morale.

Today, as the 1943 "Yearbook of Industry" issue goes to press, it is apparent that the "M's" still are vitally important in the outcome of the war. Twelve months of combat in the war zones and of preparation and production at home have not altered the fact that the successful mobilization of all five of the "M" resources is essential to victory. The only thing which has changed noticeably during the lapse of a year is the emphasis we place upon the individual "M"s.

• • •

FOR instance, consider the public attitude toward money—money to pay for the war. In the first few weeks following Pearl Harbor the seventy-seventh Congress appropriated unheard of sums for the war effort. Before it adjourned it had lifted the total appropriations for this purpose above the $200,000,000,000 level.

But while the public constantly was made aware of the tremendous cost of war, Washington was slow to undertake a vigorous campaign to raise money to meet the new expenditures. The 1942 revenue bill was not passed until just before the November elections. Even now, at the beginning of the new year, many millions of taxpayers have only a hazy idea of the burden of taxes which will be thrust upon them when they make out their returns for filing next March 15.

Not only has the government been slow in acting upon tax measures, but it has been reluctant to take a realistic view of the relation between current revenue and current expenditures. No nation in history has ever thrown as heavy a burden upon future generations as is the United States government in its policy of paying for only a fraction of the cost of war from current income.

In seeking loans, the government has been reasonably successful in its sale of War Savings stamps and bonds. This effort was given a substantial impetus by the payroll deduction plan, in which employes and employers have co-operated magnificently. However, the Treasury Department was slow to go after investment money. The first big Victory drive was launched only a few weeks ago. Its goal of 9,000,000,000—an unprecedented sum to be raised in this manner—has been exceeded.

With national income for 1942 estimated at $117,000,000,000 and with an even higher income in sight for next year, there need be no serious concern about financing the war. However, there is danger that the government, in its zeal for social and economic reform, may continue to toy with finance to the point where real difficulties may develop.

Certainly it is fair to say that a year ago the nation was nearly blind to its wartime financial obligation. Today it is awakening to the vital importance of this part of the war program. Perhaps the brutal truth will dawn upon most of us before the end of 1943.

After Pearl Harbor we talked of billions glibly. Before another year passes, we will be paying through the nose, and realizing that in money matters we—as a nation—were deserving of the opprobrium of "too little and too late"—to our own discomfiture

Yes, the emphasis on money has changed and will change more in 1943.

• • •

THE situation in regard to machines is much more gratifying. Considering the fact that in the middle thirties machines were regarded as an

INHIBITIONS OF MANPOWER

economic menace by some persons in high places, it is encouraging to reflect that the nation's record in regard to machines is one of the brightest aspects of the American war effort.

As indicated elsewhere in this issue, the tooling-up process so necessary to preparing American industry for large-scale production for war has progressed smoothly. Machine tools and other equipment have been furnished not only for the "arsenal" at home but also for a number of the United Nations. The fact that the output of machine tools increased in value from $800,000,000 in 1941 to $1,400,000,000 in 1942 is a glowing tribute to the energy, resourcefulness and ingenuity of machine tool builders. Manufacturers of other industrial equipment have kept pace with the tremendous requirements of wartime industry. In short, the machine and equipment builders of America have met the challenge of war superbly. At a result the emphasis on machines in 1943 may be diminished—solely because of the forehandedness of the machine and equipment industries in 1941 and 1942.

• • •

THROUGHOUT 1942 materials have constituted one of the major problems of the war. There have been definite shortages at times, but when the war is over and we can look back dispassionately at the hectic events of 1942 we may conclude that our troubles in materials were caused not so much by actual shortages as by inability to distribute available supplies equitably and intelligently.

Certainly the 12 months have witnessed marked changes in the materials outlook. A year ago we heard all sorts of dire predictions about the breakdown in aluminum. Today aluminum does not appear to be a serious problem.

As recently as Maritime day, some government officials were saying that the merchant ship program for 1942 would be limited solely by the tonnage of ship plates available. Today plate production is ahead of ship consumption of plates and merchant ship output is ahead of schedule.

One could cite numerous other instances wherein materials—scarce to an acute degree a year ago—today are available in greater volume. The easier situation is the result of a number of factors. Production facilities have been improved and expanded. As the war progressed and it was possible to know more clearly what types of materials would be needed and what volume, scheduling was improved. Most important of all, the evolution in the government machinery for getting the right amount of the right kind of material to the right place at the right time has resulted in a slow but sure improvement in distribution.

This is not to say that all of the problems of materials supply have been solved. A few critical situations still exist and it is likely that there will be numerous bottlenecks in some material at intervals through 1943. However, the system of materials supply and allocation is working more smoothly. Many of the old difficulties will not arise again during this war.

The principal headaches in materials during the new year are likely to be those caused by adjustments made necessary by the tide of battle. It is reasonable to expect that the requirements for effective fighting—munitions, ships, etc.—will be met more satisfactorily in 1943 than in 1942. Materials for nonessential use will be tighter—certainly during the first half. Relief in some civilian lines now drastically restricted may be forthcoming before the end

of 1943. Easements to maintain necessary domestic activities will be in order soon. More steel for cars and locomotives—now in sight—will be followed by more materials of many kinds to keep the great American industrial plant in efficient operating condition.

Thus in 1943 the emphasis on materials may be shifted from problems of production to problems of distribution and effective use.

* * *

THE "M's" discussed to this point—money, machines and materials—are the tangibles among our national resources. We know from experience that, given time, we can lick most problems involving them. We cannot be as cocksure about the intangible "M"s—men and morale.

For the purposes of this discussion these two resources can be considered together. Morale is distinctly an integral part of the manpower problem. Morale is the quality which multiplies or divides the effectiveness of manpower. Men imbued with a high resolve to do or die can perform miracles. Men not thus inspired can work laboriously without achieving satisfactory results.

In wartime the most potent morale builder is the humane desire of the public to avoid as far as possible the unnecessary sacrifice of its young men at the front. As more and more of the cream of American manhood go to the war zones to fight, the greater will be the national urge to support them with everything which can be provided for their safety and success.

With a million men now overseas, and more embarking almost every day, one can count upon a steady lift in national morale. The progress in this direction may not be as rapid as could be desired, but it is inevitable and it is reassuring. Barring some unforeseen development or grievous blunder in national policy, morale will take care of itself.

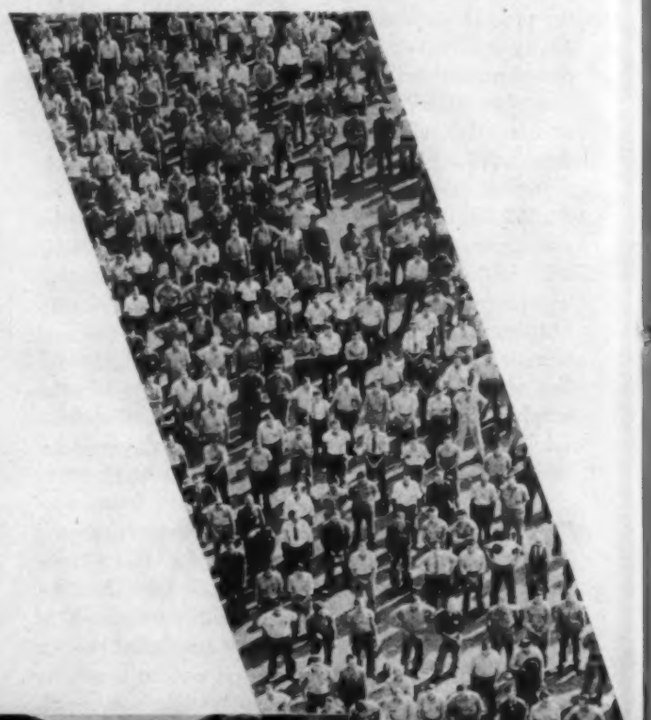
* * *

ASSUMING that morale will gradually improve, what about the big "M" of men or manpower? As the reader peruses the pages of this issue he may conclude that manpower looms as the No. 1 problem of 1943. Is this a justifiable conclusion?

We believe the answer is "yes." This is said rather confidently, partly because so many intangibles —in the form of present unsolved problems—fall in the category of manpower.

Manpower is more than a matter of numbers or volume or capacity. It is important, of course, to know whether or not we have a sufficient number of able-bodied men and women to do all the things required to win the war and to keep the domestic economy from disintegrating. But if we have enough or nearly enough (apparently we have little or no surplus), the obviously important problem is to employ every available individual at the task where he or she can contribute the most to the war effort.

This is a big order. Its numerous ramifications are going to be impressed upon us with increasing emphasis throughout the new year. It is a big order because it embraces better-than-ordinary performance on the part of so many different types of people.



For instance, consider the manpower problem of the iron, steel and metalworking industries. It involves not only the difficult decision as to which workers shall remain on the production front while others go to the fighting fronts, but also a host of related factors such as the training and conditioning of novices recruited for the emergency; the complicated questions of proper working conditions and wage and hour standards; the relations between government, employer and employe as to wages, hours, and collective bargaining; the relations of government, employer and employe with unions; efficiency of management, and efficiency of individual employes as measured by their productivity.

A reading of many of the articles in this "Yearbook of Industry" issue will show that these and many other aspects of the manpower problem were emphasized in no uncertain terms throughout 1942. In fact, as we greet the new year we are justified in feeling that there is room for more improvement in making manpower more effective than in any other field of war effort.

This feeling was heightened in the closing days of the old year when Capt. Eddie Rickenbacker, speaking over the radio on the Army Hour, made this challenging statement:

"If through some miracle, we could bring our combat forces back to America and put them into factories—and put the present war workers out in the slit trenches and malaria-infested jungles of Guadalcanal and New Guinea—*I know that within 30 days we would see our production doubled.*"

It is safe to infer that in this statement Captain Rickenbacker is not accusing men or management of slacking on the job. Instead, he is indicting the system or the circumstances which permit the present waste of time and manpower.

What are these inhibitions which prevent us from doing the heroic job which those men from the combat zones would do if they were in our place?

Would we hold the 40-hour week as sacred?

Would we sit-down, slow-down or strike without first submitting our grievances to mediation?

Would we countenance for a minute the meddlers who whisper "Don't work to fast," or "Don't spoil the job," or "What are we going to do when this job is completed?"

Would we tolerate featherbedding in all of its vicious aspects—whether sanctioned by law or not?

Would we continue to defend the strict interpretation of state and federal laws, even when they admittedly hinder production?

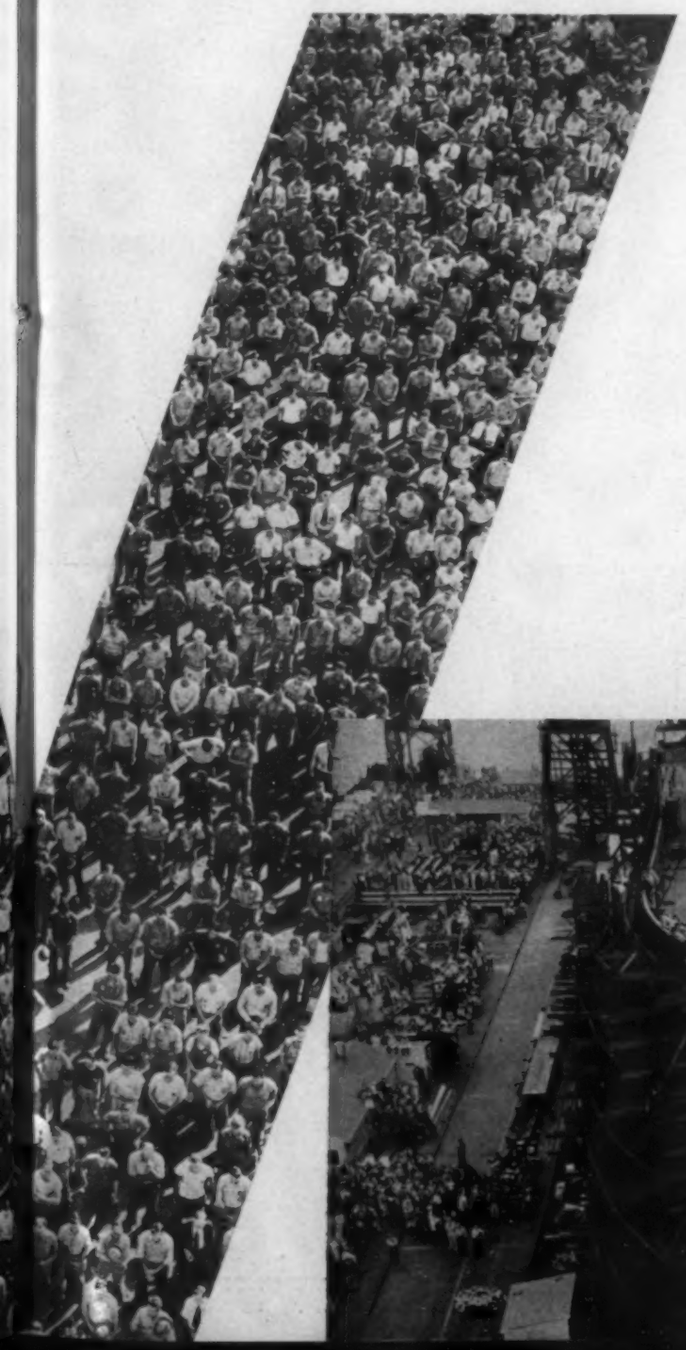
Would we continue to sit smugly complacent in the belief that a social gain—fancied or real—should take precedent over an efficiency in production which would save lives at the front?

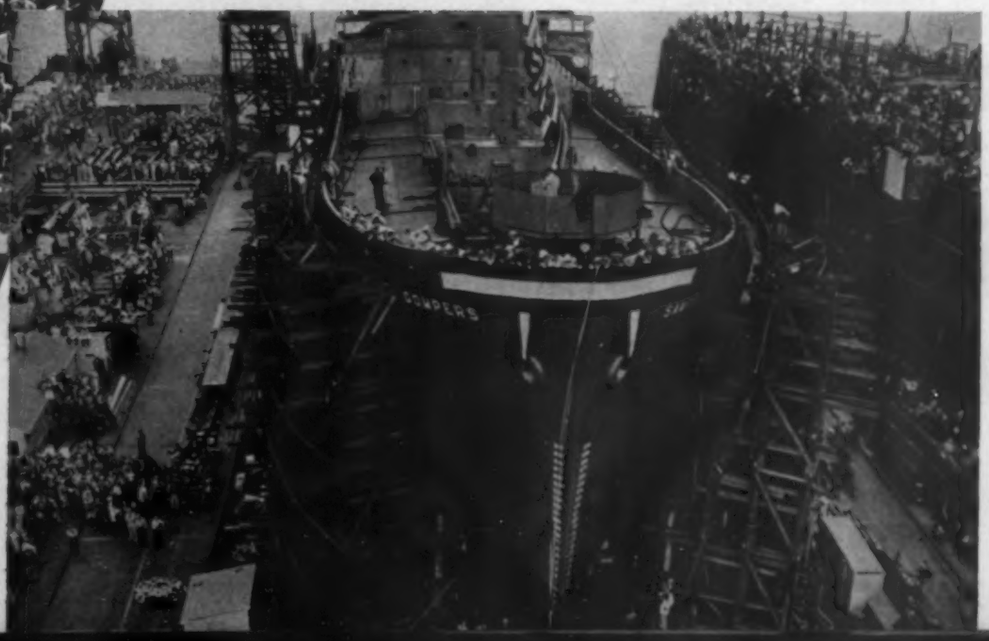
Would we accept red tape as a necessary obstacle to efficiency in the use of manpower?

* * *

ONE of the big jobs in 1943 will be to remove these inhibitions—to make the system at home match in courage, sacrifice and result the system which prevails at the battle front.

THE EDITORS





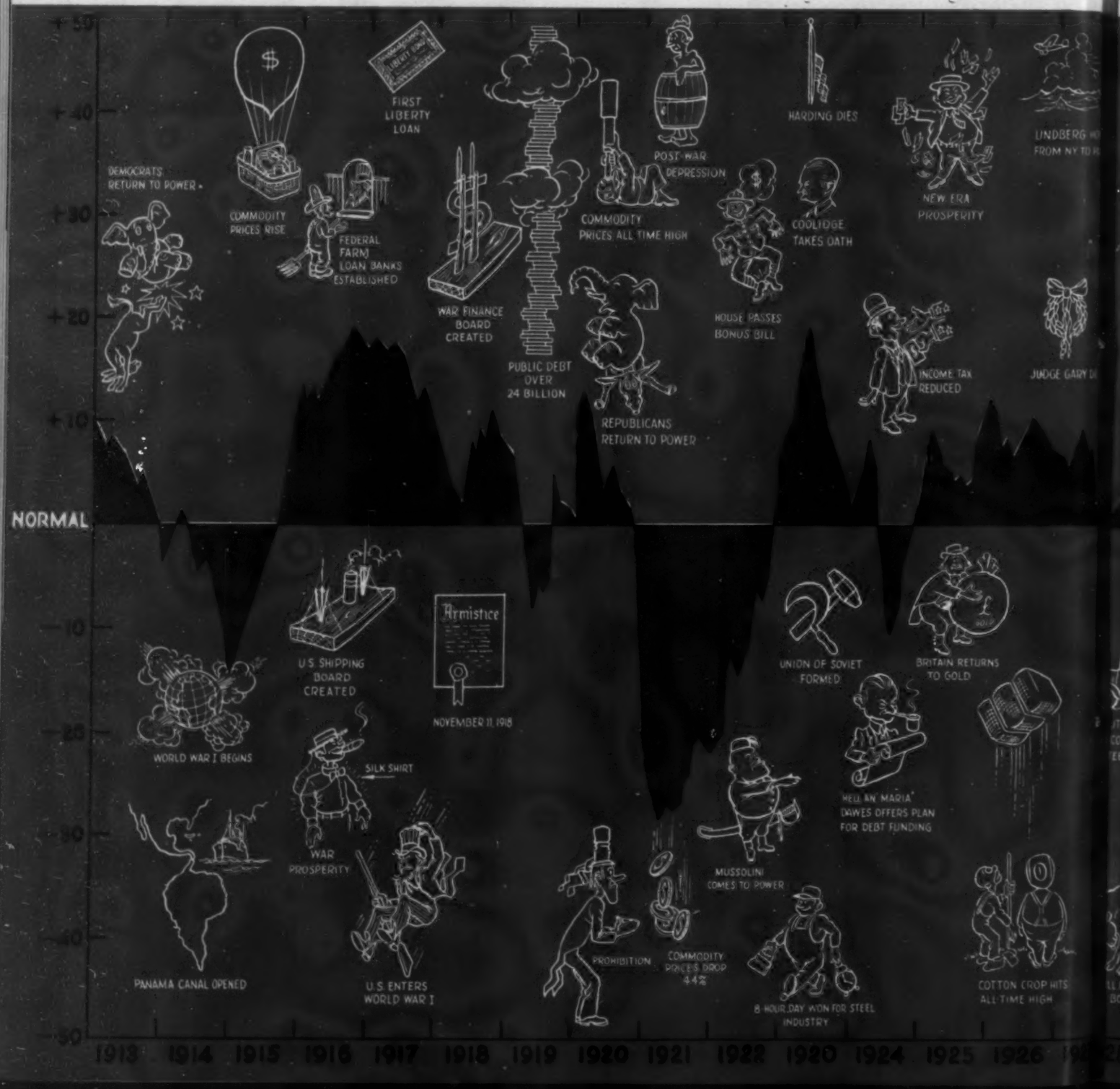
THE BUSINESS TREND

Industry Tightens Its Belt for Second Year of War

RISING volume of munitions output, additional restrictions upon civilian goods production and use and further upturn in wholesale commodity prices, highlight the economic outlook for 1943.

A continuation of the steady upward trend in industrial production is indicated for the first half of 1943, in contrast with the early months of 1942 when plant conversion prevented a rise in total output. Although over-all production may show a tendency to level off during the latter part of 1943, the average increase for the year probably will be about the same as in 1942, which is now estimated between 10 and 15 per cent.

Over half of current industrial production is for war, while more than 80 per cent of durable goods output falls in the same category. Further inroads are expected to be made into the production of consumers goods during the months ahead. Closely tied in with this development has been the marked increase in war expenditures.



These now exceed $6 billion monthly, compared with $153 million just prior to the outbreak of war in Europe.

The prospective reduction in supply of civilian goods throughout 1943 will occur at the time industrial production and pay rolls are expanding. This situation will necessitate consumer rationing of a growing list of commodities.

Supply of carbon and alloy steels, magnesium, aluminum, zinc, copper and other critical materials is expected to be greater in 1943. However, there is a question as to whether the supplies of some of these materials will be sufficient to meet expanding war needs.

The present labor shortage is expected to become more severe before improving. However, extensive hiring of women in war plants should relieve this situation. It is also felt that further limitations on consumer goods production may conceivably be enforced even in industries where the supply of materials and plant facilities are adequate, in order to release labor for war work.

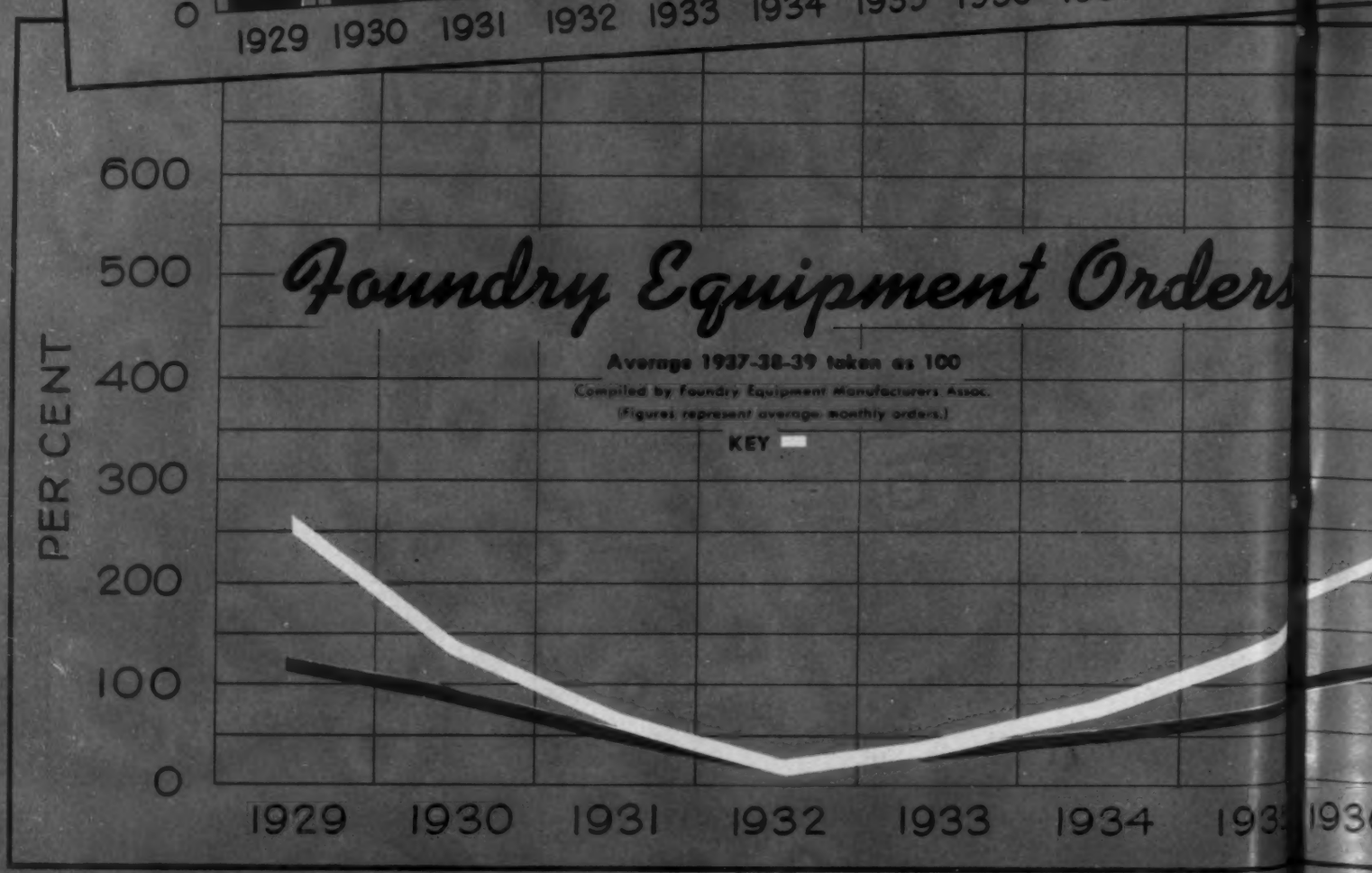
Munitions output in 1943 will be limited by scarcity of materials, dwindling manpower and overburdened transportation facilities.

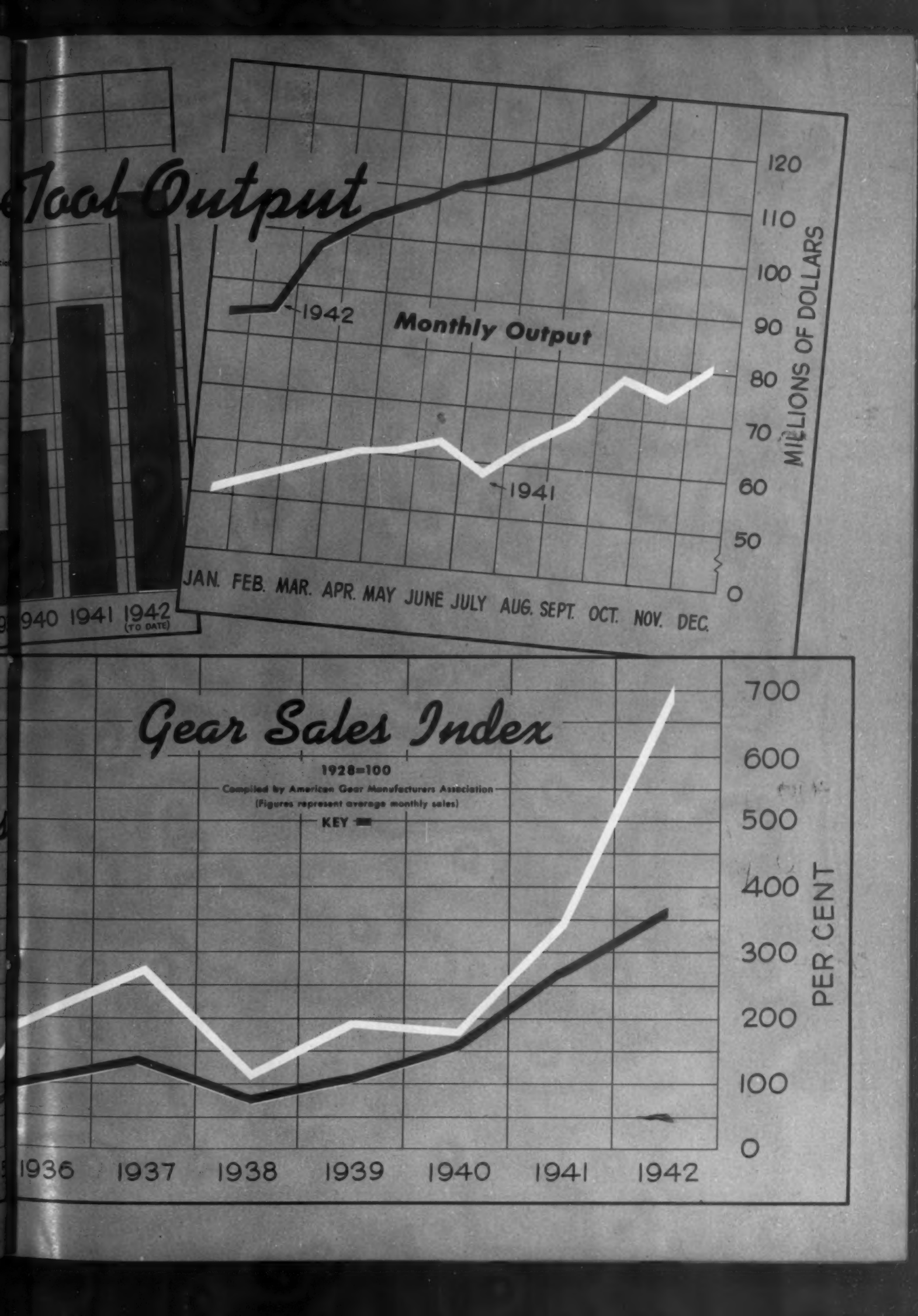
Marked improvement in methods of production and distribution, simplification and standardization of product, and newly found uses for materials in an effort to replace critical materials, have resulted from intensive research and development work during the past two years. All of which is adding an immeasurable new wealth of "Know-How" to aid our industrial economy in the postwar period.

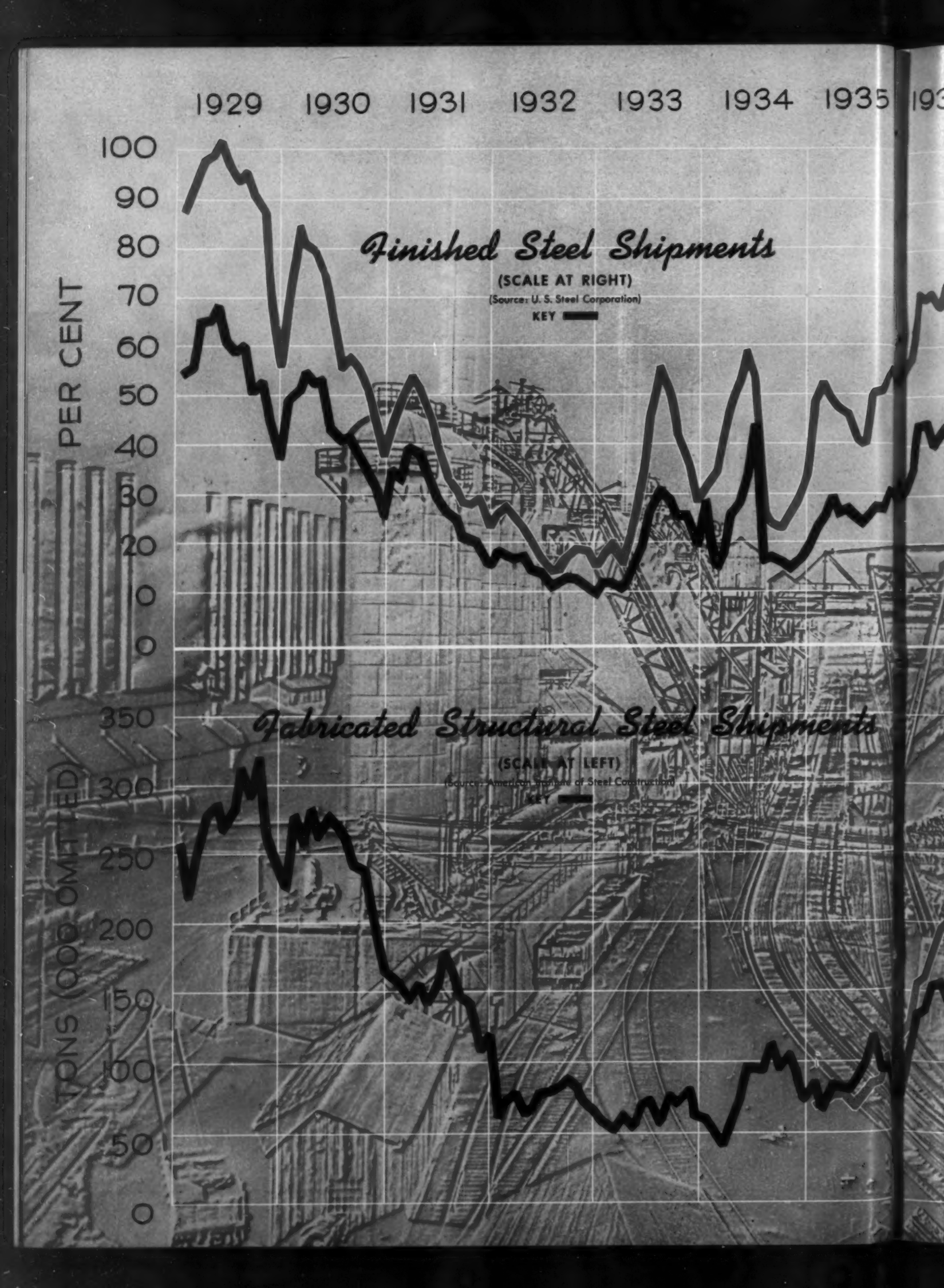
(Trend Line Compiled by: Cleveland Trust Co.)

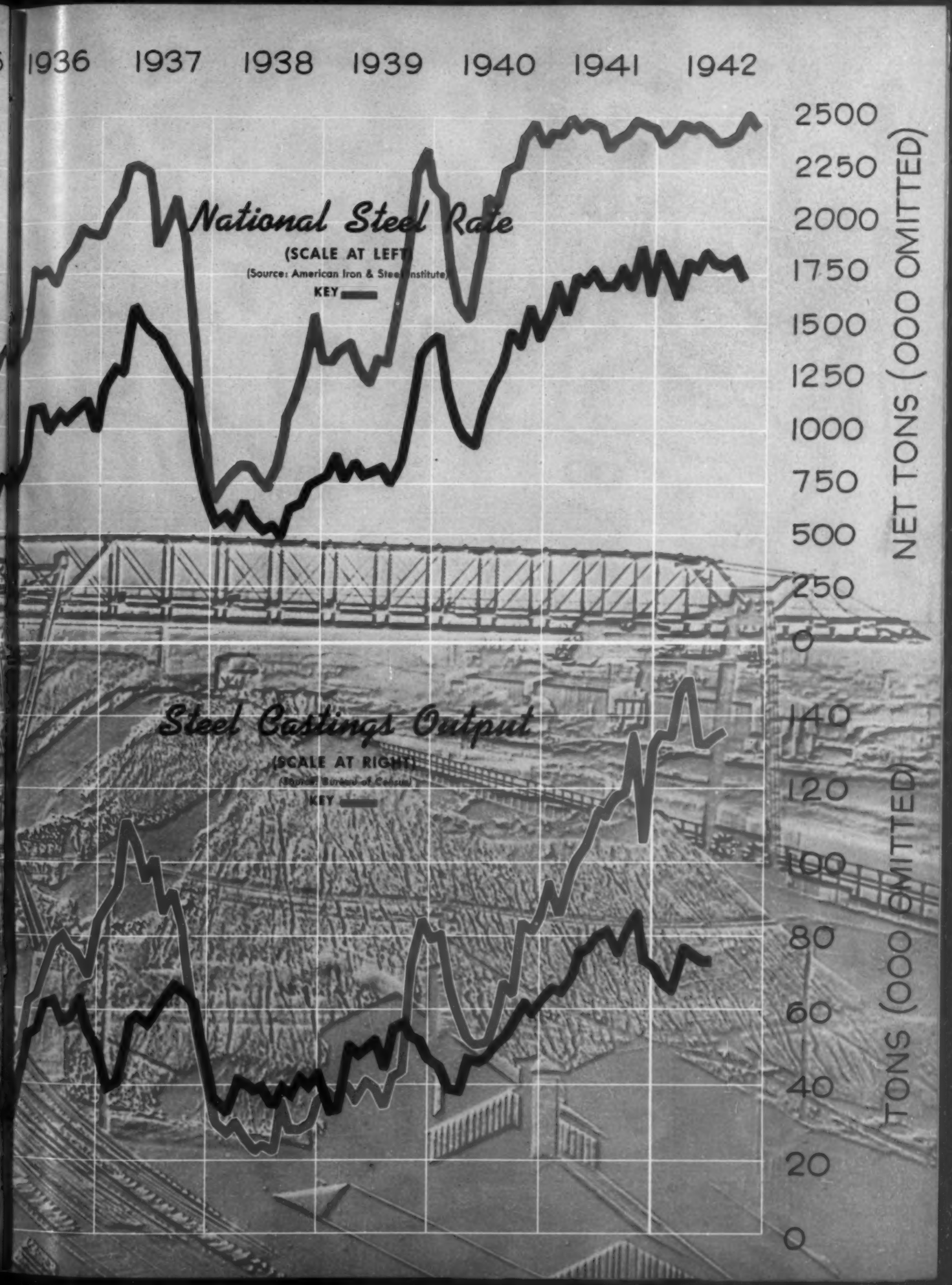
LAVAL VISITS U.S.
STOCK EXCHANGE PANIC
BANK HOLIDAY
DEMOCRATS RETURN TO POWER
MUSSOLINI CROWNS VICTOR EMANUEL EMPEROR OF ETHIOPIA
NRA DECLARED UNCONSTITUTIONAL
HITLER COMES TO POWER
THE GREAT DEPRESSION
ETHIOPIA INVADED BY ITALY
CONGRESS REPEALS ARMS EMBARGO
CHAMBERLAIN FLIES TO VISIT HITLER
FDR ATTEMPTS TO PACK SUPREME COURT
SIT-DOWN STRIKES APPEAR
STEEL PRICES FROZEN AT 1ST QUARTER 1941 LEVEL
FRANCE FALLS, AIDED BY ITALIAN STAB
GERMANY ATTACKS RUSSIA
GERMANY INVADES POLAND
ITALY & BRITAIN CONCLUDE PEACE PACT
GERMANS START MASS AIR RAIDS ON ENGLAND
FOR VICTORY BUY U.S. BONDS STAMPS
50+
20+
10+
NORMAL
10
20
30
40
50
TO INDUSTRY COMES LARGEST REEL CONSUMER
NAZIS MAKE BIG ELECTION GAINS
SUN OF PROSPERITY EMERGES FROM CLOUDS OF DEPRESSION
SPANISH CIVIL WAR BEGINS
DROUGHT HITS U.S. FARM BELT
WPA CREATED
JAPAN INVADES CHINA
U.S. SCRAPS 1911 COMMERCIAL TREATY WITH JAPAN
RATIONING BEGINS: SUGAR GAS TIRES COFFEE ETC.
GERMANY & RUSSIA SIGN 10-YEAR NON-AGRESSION PACT
JAPS MAKE SNEAK ATTACK ON PEARL HARBOR
GERMANY ITALY & JAPAN SIGN 10-YEAR POLITICAL MILITARY & ECONOMIC TREATY
AMERICAN TROOPS LAND IN AFRICA
BRITAIN & FRANCE DECLARE WAR ON GERMANY
U.S. AT WAR WITH ITALY GERMANY & JAPAN
1928 1929 1930 1931 1932 1933 1934 1935 1936 1937 1938 1939 1940 1941 1942

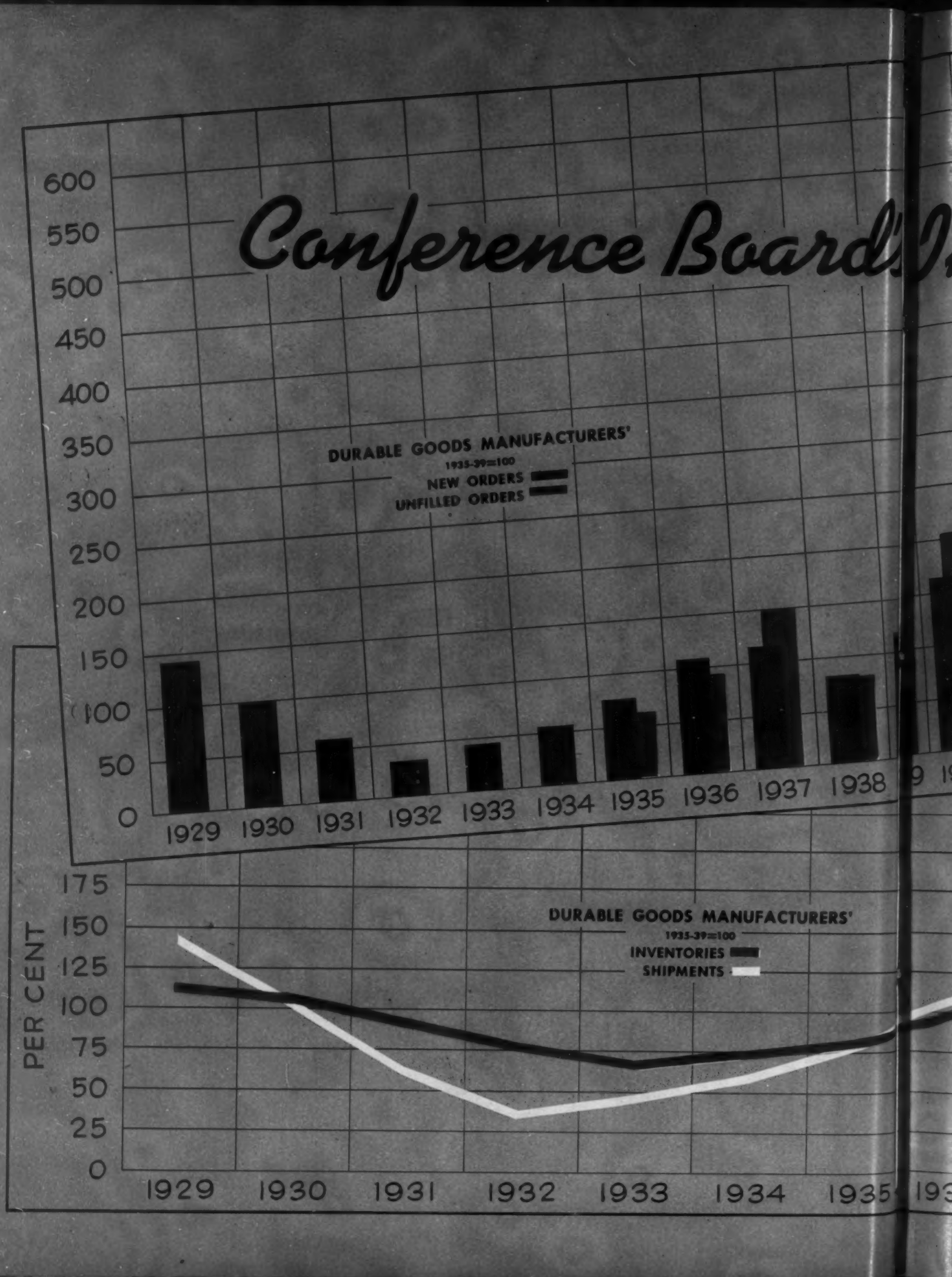
Machine To
DOLLAR VALUATION
Compiled by
National Machine Tool Builders Associ
MILLIONS OF DOLLARS
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
Yearly Output
1929 1930 1931 1932 1933 1934 1935 1936 1937 1938 19 940


Foundry Equipment Orders
Average 1937-38-39 taken as 100
Compiled by Foundry Equipment Manufacturers Assoc.
(Figures represent average monthly orders.)
KEY
PER CENT
600
500
400
300
200
100
0
1929 1930 1931 1932 1933 1934 193 193


Tool Output
940 1941 1942
(TO DATE)
Monthly Output
1942
1941
120
110
100
90
80
70
60
50
0
MILLIONS OF DOLLARS
JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC.
Gear Sales Index
1928=100
Compiled by American Gear Manufacturers Association
(Figures represent average monthly sales)
KEY
700
600
500
400
300
200
100
0
PER CENT
1936 1937 1938 1939 1940 1941 1942


1929
1930
1931
1932
1933
1934
1935
100
90
80
70
60
50
40
30
20
10
0
PER CENT
Finished Steel Shipments
(SCALE AT RIGHT)
(Source: U. S. Steel Corporation)
KEY
350
300
250
200
150
100
50
0
TONS (000 OMITTED)
Fabricated Structural Steel Shipments
(SCALE AT LEFT)
(Source: American Institute of Steel Construction)
KEY


1936
1937
1938
1939
1940
1941
1942
National Steel Rate
(SCALE AT LEFT)
(Source: American Iron & Steel Institute)
KEY
2500
2250
2000
1750
1500
1250
1000
750
500
250
0
NET TONS (000 OMITTED)
Steel Castings Output
(SCALE AT RIGHT)
(Source: Bureau of Census)
KEY
140
120
100
80
60
40
20
0
TONS (000 OMITTED)


Conference Board
DURABLE GOODS MANUFACTURERS'
1935-39=100
NEW ORDERS
UNFILLED ORDERS
600
550
500
450
400
350
300
250
200
150
100
50
0
1929
1930
1931
1932
1933
1934
1935
1936
1937
1938
DURABLE GOODS MANUFACTURERS'
1935-39=100
INVENTORIES
SHIPMENTS
PER CENT
175
150
125
100
75
50
25
0
1929
1930
1931
1932
1933
1934
1935

Index
UNFILLED ORDERS
NEW ORDERS
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
JAN
FEB.
MAR.
APR.
MAY
JUNE
JULY
AUG.
SEPT.
OCT.
NOV.
DEC.
1941
1942
9 1940 1941
275
250
225
200
175
150
125
100
75
50
25
0
PER CENT
1936
1937
1938
1939
1940
1941
1942

"Easier To Plan"

Carefully and constantly checked are the performances of American munitions on the fighting fronts and the balance between the various types. Weakness in performance or an unbalance in needed supplies causes war production heads to change specifications, correct production schedules

FOLLOWING a year of spectacular achievement, industry faces still greater demands in 1943, and still greater chances for fulfilling them.

These demands, of course, are war demands, and those developing from essential civilian activities, all others having been practically wiped out. With steel consumption thus restricted, and production increasing, military requirements will be met. And there will be more to spare than at present for railroads, public utilities, farm implement manufacturers and certain other important groups.

Undoubtedly there will be many "headaches," unexpected demands, "squeezes," the emergencies inherent in all hard-fought wars. The first impact, however, is over, the decks have been cleared, and with the initiative gradually swinging to the Allies, the whole pattern of the war becomes more clearly defined. It should be less difficult to plan ahead in 1943 than it was in 1942.

Moreover, the government's organization for planning, executing plans and for co-ordinating efforts is becoming somewhat more proficient. To date, efforts have involved much experimentation, with one plan succeeding another, with various changes in personnel and agencies multiplying and expanding. Only now, after more than two and a half years of defense and war emergency does there appear to be a semblance of unified control.

As was true a year ago, the steel industry's two major individual problems are distribution and sufficient metallics, pig iron and scrap, to meet expanding steel requirements. Last year, at the start, the former appeared the

...in 1943"

★ ★ ★ ★

Due to More Centralized Control

Matching of materials supply to materiel needs to be major task. Essential civilian industries may obtain more; little hope seen for non-essential goods

less difficult. Refinements in allocation and priority controls, then being undertaken in Washington, encouraged many to believe that before the year got far under way the distribution problem would be solved to a considable degree. Such was not the case; rather it got even tougher.

There were improvements in some directions—distribution of plates and pig iron, for instance, under allocation. But in the main the Production Requirements Plan, the allocation classification program and priorities, on which most reliance was placed, bogged down. There were charges of "steel shortages," Congressional inquiries, no end of confusion with respect to priorities, limitation orders, inventory controls, questionnaires and a general mass of paper work which had to be kept up if the industry and its customers were going to be permitted to function at all.

Undoubtedly much of this was to be expected in the frantic effort to get the country on a real war footing as quickly as possible; and, too, the fact remains that an enormous quantity of steel did go into armaments. But distribution, obviously, left much to be desired.

Today it is the Controlled Materials Plan that balances supply against demand, operates vertically instead of horizontally, as in the case of PRP, and, in short, aims to provide quantity and type of materials at the time required to meet approved schedules. Applying at present to steel, copper and aluminum, it is scheduled to get partially under way by second quarter and under full operation by the third quarter. It is somewhat similar to one in successful operation in England and incorporates certain principles used by this country in the first World War. So again the industry, as well as Washington, enters the new year with renewed hope that distribution will function more smoothly than in the past.

Meanwhile, other measures are at work. The Steel Recovery Corp., organized by the government last summer,

Magnitude of the present war effort dwarfs that of 1917-18. Likewise, the extent of co-operation between labor and management to accelerate material production exceeds anything before witnessed in this country

has a program for reclaiming stocks, which have been built up by active manufacturers in excess of needs, or by manufacturers who have been forced to suspend operations because of limitations on civilian needs. It is estimated there still are something like 16,000,000 to 18,000,000 tons, held principally in the hands of active manufacturers and amounting to about three months production or more in terms of finished steel.

Of special importance also are the limitations on the use of steel for nonessential civilian products. Important limitations of this character marked the course of the entire past year, and their cumulative effect should be pronounced in 1943.

They began, notably, with automobiles and then spread to various other durable consumer lines. March witnessed the issuance of numerous WPB limitation orders. Washing machine manufacturers, for instance, were told to stop production by April 15; railroad equipment buying was limited drastically, juke boxes and various other amusement devices were cut for the duration.

In May, Conservation Order M-126 banned steel in about 400 civilian articles. Under this ruling no iron or steel was permitted to be delivered for the manufacture of any of these articles, with a few exceptions, 15 days after May 5, with the further understanding that after Aug. 3 none of these items was to be assembled.

In July, WPB issued a supplementary list of 250 additional items under an amendment to M-126, although some of these products had already been affected by Order M-21, which restricted shipments to ratings of A-10 or higher. Manufacturers of this supplementary list had 30 days to process supplies on hand on a restricted basis (75 per cent of the average monthly tonnage processed in the previous year in many cases), and an additional 30 days for assembling the steel into finished products.

Many such companies have been able to get into war work and still others through their own efforts and with the assistance, perhaps, of the Smaller War Plants Corp., undoubtedly will get into such activities before many more weeks. However, a number may be forced to suspend indefinitely.

Steel Output Close to Capacity

While, as many predicted a year ago, not enough scrap and pig iron to keep open hearth production at rated capacity was available, there was enough to maintain output at a record-breaking level, and, all in all, a more satisfactory job was done in the supply of these basic materials than in distribution. Ingot production not only exceeded the preceding year's output of almost 83,000,000 tons, but exceeded it by approximately 3,500,000 tons, with an estimated total for 1942 of 86,500,000 tons; a figure, in turn, which compares with a rated capacity of around 88,500,000 tons at the beginning of last year, 89,200,000 tons at mid-year, and an estimated 92,000,000 tons at this time.

Such a showing, though short of the goal, was achieved

only through terrific effort. In pig iron, record after record was established—production, repairs, continuous running time and so forth. Operating technique and metallurgical practices reached new peaks of accomplishment and considering the shortage of furnace equipment, which delayed new construction generally, pig iron producers did an excellent job.

The scrap trade, laboring under many handicaps, performed excellently, with their efforts buttressed by a nation-wide drive during the last half of the year which was participated in not only by the dealers and consumers themselves but by the public at large.

A number of steel companies, for the first time found themselves late last fall with at least a fair reserve, badly needed for the winter season. However, the whole scrap problem remains pressing, due to a continued shrinkage in replacement material, and consequently the nation-wide program for the recovery of dormant scrap is scheduled to continue without relaxation throughout the coming year.

Owing to severe shortages which developed in scrap, there has been an increasing reliance on pig iron. From the 557 tons of pig iron consumed for each 1000 tons of open-hearth steel produced in 1941, the ratio has been increased in recent months to 593 tons, according to the American Iron and Steel Institute. Scrap consumption per 1000 tons of open hearth steel dropped from 523 to 496 tons, with the burden on scrap further relieved by the use of a slightly larger proportion of iron ore in the open hearth charge.

While pig iron capacity has continued to expand, there has been a curtailment of more than 21 per cent in the long-term expansion program as first proposed by W. A. Hauck, head of the steel planning unit of the Iron and Steel Branch in 1941. Last summer, when announcement of the curtailment was made, it was estimated that pig iron capacity by the middle of this year would exceed 70,000,000 tons, of which approximately 61,000,000 tons would be available for steel, with the remainder representing merchant grades and ferroalloys. However, it is now believed that the figure by mid-year will not exceed 69,000,000 tons, and that little will be added in the last half. Last summer capacity was about 64,000,000 tons and is estimated now at slightly less than 67,000,000 tons.

Construction Phase Drawing to Close

With the increase in pig iron capacity there will be a further gain in steelmaking capacity, with the current figure of about 92,000,000 to be increased within next six months to approximately 96,000,000. As in pig iron there has also been a general curtailment in the original program for expanding steelmaking facilities and certain finishing capacity.

Curtailment has been in line with Washington's broad policy of curtailing all construction, where possible. Non-war construction was hit first, having long since been brought to a virtual halt; then war plants, with concentration of men and materials on production in such facilities as are available or are well under way, the primary aim. Thus, in a broad sense, the first phase of the war program —the construction phase—is drawing to a close. Exceptions still are notably the synthetic rubber program, which

started late, and the high test petroleum products plan.

Alloy steel continues to be one of the principal bottlenecks, with production being stepped up currently to about 14,000,000 tons a year, compared with an estimated production in 1942 of more than 11,000,000 tons. Today open-hearth alloy steel is being produced at a rate of 8,000,000 tons annually, with output of electric furnace steel, comprising largely the alloy grades, being increased.

In point of actual capacity, electric furnaces were rated at approximately 3,700,000 tons at the beginning of last year, and 4,200,000 tons at the end of last June. Today the rate is estimated at more than 4,600,000 tons, with the probability that by the close of next June it will be up to more than 5,100,000 tons.

The steel industry, in co-operation with the war agencies, devised many conservation measures, including notably the National Emergency steels, requiring less nickel and other critical alloying elements, and more manganese and silicon to offset these reductions. Greater use of residuals available in scrap is a part of this program, and, in one instance, the alloy steel committee, American Iron and Steel Institute, created an entire new series of NE steels in ten days, at the request of WPB, with the new steels to be solely from scrap for replacement of other alloys without changes in designs of parts.

Plates led all products last year in point of tonnages, with sheets of all kinds comprising the next highest classification, and with semifinished and merchant bars following in order. According to preliminary estimates, next came structurals, tin plate, alloy bars and narrow strip. Plates are considered likely to lead again this year, in view of the further heavy expansion scheduled to take place in shipbuilding in particular.

Plate Production Expands

Expansion in plate output last year was a feature in finished steel. So heavy and urgent were requirements that continuous strip mills were brought into action and during the past several months plates were being produced at about 1,100,000 tons per month, or almost twice the amount in the corresponding period of the preceding year. However, stringency in plates has eased for the present due to this increase and to a better balancing of consumer inventories, with a result that a still higher tonnage, which could be produced, is not being called upon. But, with the further large jump scheduled in shipbuilding a new record in plate production may yet develop.

The Conservation Bureau, WPB, recently placed plates fourth on one critical list of finished steel products, with bars, forgings and seamless tubing ahead. Interestingly, in another list composed of special steels, the bureau classified in the order of their scarcity and importance chrome-nickel stainless steel, tool steel, straight chrome stainless steel and other alloy steels. Low-phosphorus pig iron and wrought iron were also listed among the critical products. Of the ferroalloys, the most critical were molybdenum, nickel, vanadium, tungsten, cobalt, chromium and calcium silicon.

Magnesium, aluminum and copper were recently rated by Donald M. Nelson as the three most critical metals, although he added that capacity for producing the first two metals had increased to an extent that "would have been considered fantastic several years ago."

While details of war production schedules are necessarily being considerably withheld, Mr. Nelson estimates that war goods (including military construction) worth $80 to $85 billions will be produced this year, against $43 billions last year. In 1942 a considerable portion of the value was accounted for by construction. This year with building curtailed, the increased value set on war production will represent greater activity in other lines than is apparent on the face of the totals.

This year's minimum goal for merchant shipbuilding has been definitely set at 16,000,000 deadweight tons, or almost twice the record breaking total of 8,200,000 tons estimated to have been reached in 1942. Mr. Nelson recently indicated that merchant ship production over the next 12 months might even reach 18,000,000 or 20,000,000 tons. Naval construction also will undergo further heavy expansion.

Airplane production will come in for continued greater emphasis. Last year the President announced a goal of 60,000 airplanes for 1942, and 125,000 for 1943. Produc-

MEN AND MONEY—FROM EVERY WAR PLANT

Huge thermometer registers and helps stimulate War Bond sales in the plant of Northern Pump Co., Minneapolis, above. At right, two employes of the Caterpillar Tractor Co., Peoria, Ill., pick out the names of friends in the services on one of the honor rolls erected in the plant. War factories have made extensive use of slogans, posters and various other displays to encourage bond sales, increase production and reduce scrap waste

tion last year fell short by 11,000 planes, due principally to greater emphasis on bombers, and it is possible that the schedule for this year has likewise been revised. Mr. Nelson said recently that the average monthly production of 1943 would be double that of the closing months of last year, but that was as far as he went.

Extent of the combat tank program for this year also has not been definitely indicated. Last year the goal was 45,000, but actual production was 32,000, including self-propelled artillery. Here again there were changes in requirements and design and during the late fall reductions were made in at least several important contracts. Production of military trucks, jeeps and certain other types of motorized equipment also was curtailed, but this appeared to be due more to the fact that, if anything, output exceeded earlier predictions.

Approximately 17,000 antiaircraft guns larger than 20-mm were produced last year, but now there is to be a reduction in certain types, especially those designed for home defense, with an increase to be made in others for ships and active combat duty abroad. All this already has affected the shell program.

Character of the whole armament program is being shifted from defense to attack, and thus many changes are probable in munitions requirements. As a result the new year may start off relatively slowly in some armament centers, pending changeovers.

Nevertheless, Mr. Nelson assures, America alone by the end of this year will be producing almost as great a volume of combat armaments as all the remainder of the world combined, Allies and enemies together. Production will then be nearly twice as large as that of the Axis, and, he adds, United Nations output will be nearly three to one ahead of Axis production.

$240 Billions Authorized for War

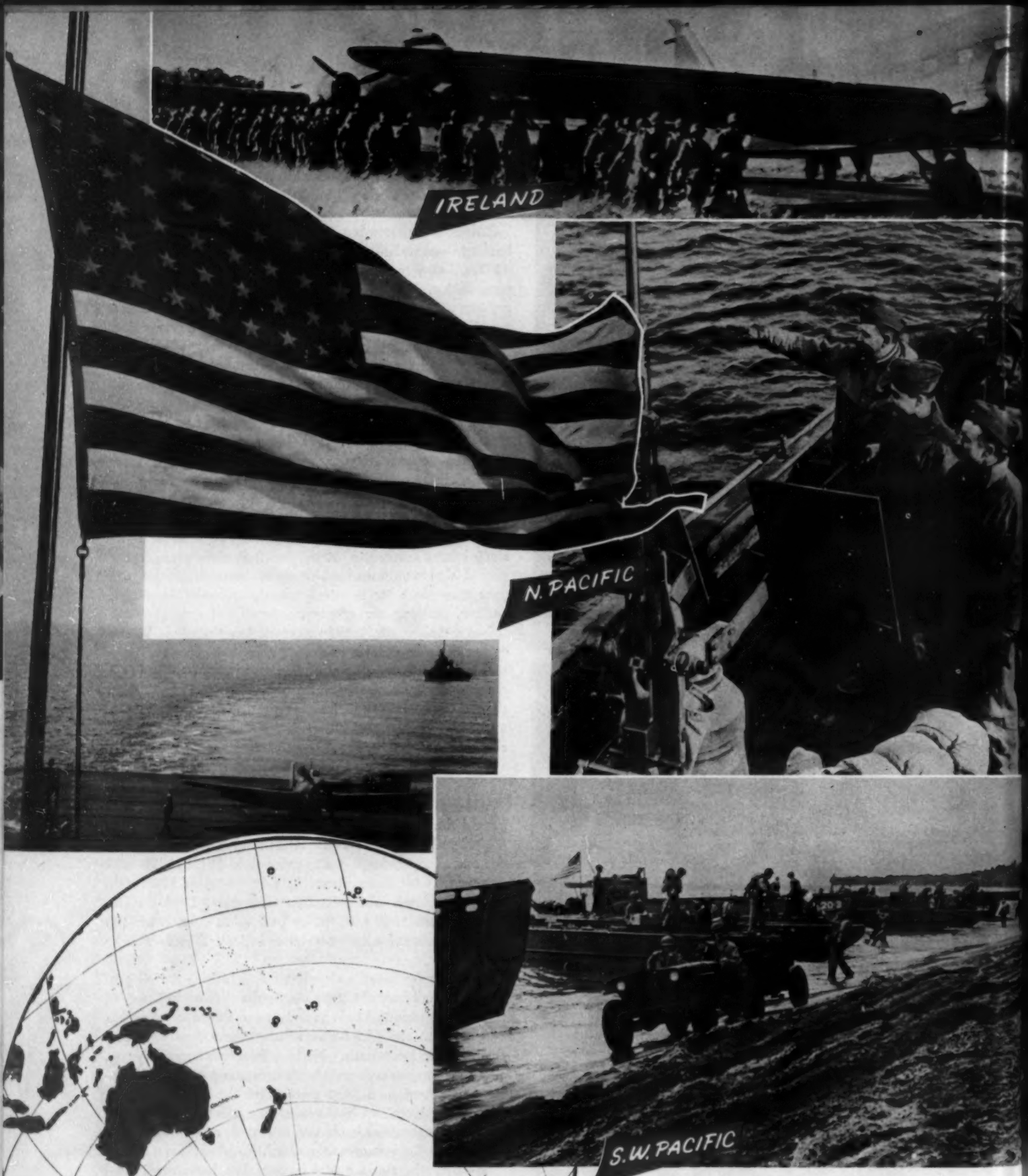
Always an interesting index, monthly war expenditures passed the $6 billion mark for the first time in November, $6,042 million to be exact. This brought total costs since the end of June, 1940, up to more than $61.7 billion and compared with expenditures in July, 1940, of $186,000,000. Total war authorizations from July, 1940, to December were $240 billions, or well more than twice the national income for last year, on an estimated basis of $116 billions.

The sharp political swing last fall, which exceeded predictions and brought to Congress a better balance of strength, is expected to bring to an end the broad granting of power to the Chief Executive without first a careful definition of limitations. No one thing over recent years, perhaps, has caused greater consternation to many Congressmen, and to a large portion of the public as well, than the manner in which emergency power has been executed to accomplish ends not intended, or contemplated, at the time the power was granted.

Already the temper of Congress has been manifested by the refusal of the House last month to advance a bill giving to the President authority on tariff and immigration laws in furtherance of the war effort, and whatever concessions the new 78th Congress may eventually make, it appears they will at least, be clearly defined.

There will be a real effort to subordinate social reforms

(*Please turn to Page* 431)



AMERICAN EQUIPMENT FOLLOWS
THE FLAG ON ALL SEAS
AND CONTINENTS

Ships, tanks, planes, guns, locomotives built by American manufacturers are being tested on far-flung battle fronts, as these illustrations show

American paratroopers, left above, train for active duty in northern Ireland. United States Marines guard the Aleutians, middle left, against nuisance Jap invasions. Jeeps and landing barges line the sandy beach at Guadalcanal Island as the Marines launch their offensive against the Japs, left below

Coast Guardsman aboard a schooner challenges a suspicious-looking craft in the north Atlantic, upper right. Lend-Lease material is reaching England in quantity

Middle right, an American-built locomotive is unloaded. Lower right, American and British fighters board small, speedy landing craft, preparatory to invading Algiers

MANPOWER ... LABOR

Employment in war factories expanded by more than 10,000,000 in year, with still further increases in sight. More women workers to be recruited. McNutt czar over all civilian and military manpower

THE tremendously important problem of manpower was officially recognized as long ago as last April, when President Roosevelt, by executive order, established under the Office of Emergency Management the War Manpower Commission, with Paul V. McNutt as chairman. But it was not until last month, after a long intervening period of confusion as to responsibility and general policy, that broad control, under another executive order by the President, was finally vested in Mr. McNutt—control over both military and civilian manpower.

Subject only to checks by the President and, possibly, in an advisory way, by the farm-labor-management committee to be set up under the executive order, Mr. McNutt now, it appears, has the sweeping authority needed to clarify policy and stimulate action on his program.

His power stems principally from Section 5 of the latest executive order, which authorizes the chairman to "take all lawful and appropriate steps to assure that (a) all hiring, rehiring solicitation and recruitment of workers in or for work in any establishment, plant, facility, occupation or area designated by the chairman as subject to the provisions of the section shall be conducted solely through the United States Employment Service or in accordance with such arrangements as the chairman may approve."

While Chairman McNutt hopes to accomplish much through voluntary co-operation, it appears he has the right to order that all hiring be done through federal employment service (which in itself should be a very effective control); and the right to shift workers to more essential jobs. He also has control of the Selective Service System, with his overall task aided further by the executive order which also bans voluntary enlistment and lowers the military draft age from 45 to 38.

During the past year employment, direct or indirect, in war work increased around 7,000,000, to more than 17,500,000. Chairman McNutt estimates that the number this year will have to be stepped up to 20,000,000 and probably more. He believes that probably 5,000,000 new workers will have to be found and looks to women to supply at least 3,000,000 of this number. At present 4,000,000 women are employed in war industries. He de-

Lunch hour over, these women workers, above, troop back to work in the Todd Erie Basin shipyard repair plant in Brooklyn, N. Y. They work as mechanics, welders and electricians

—o—

At left, youths receive instructions on machine tool operation. Never before in history have operators been trained and placed on production jobs so rapidly

scribed the scarcity of expert machinists and tool and die makers as critical.

Following a long and difficult period of planning, a long-term goal as to military needs was set up last October. This called for an army of 7,500,000 by the end of this year, compared with around 4,250,000 at present, and a navy of 1,500,000, which is about double the current number. Behind these 9,000,000 fighting men, some government officials declare there should be a total working force of 62,500,000, including at least 10,000,000 on the farms.

To facilitate the manpower problem, approximately 130 manpower areas are being set up, each with a director and with representatives of the United States Employment Service to provide adequate machinery for training, recruiting and placing labor. Inspectors, it is said, will be assigned to various industries to check on labor hoarding and to otherwise see that workers are being utilized to the best possible effect. Just how all this will work out in practice remains to be seen. If a surplus of labor is

Former salesgirl, right, left her department store job to operate a punch press in the new Port Newark, N. Y., yard of Federal Shipbuilding & Dry Dock Co., United States Steel Corp. subsidiary

UNITED STATES LABOR FORCE, WAR AND NONWAR EMPLOYMENT

(December, 1941 to December, 1943, in millions of persons)

	December, 1941				December, 1942				December, 1943			
	Total	Male	Female	% F	Total	Male	Female	% F	Total	Male	Female	% F
Labor force excluding armed forces	54.0	40.2	13.8	26	53.5	37.9	15.6	29	53.5	35.1	18.4	34
Unemployed	3.8	2.6	1.2	32	1.5	0.9	0.6	40	1.0	0.6	0.4	40
Employed	50.2	37.6	12.6	25	52.0	37.0	15.0	29	52.5	34.5	18.0	34
Agriculture	8.3	7.8	0.5	6	8.1	7.5	0.6	7	7.9	7.1	0.8	10
Nonagriculture	41.9	29.8	12.1	29	43.9	29.5	14.4	33	44.6	27.4	17.2	39
Self-employed, proprietors and domestic servants	5.8	3.0	2.8	48	5.3	2.8	2.5	47	5.0	2.7	2.3	46
Employes	36.1	26.8	9.3	26	38.6	26.7	11.9	31	39.6	24.7	14.9	38
War	6.9	5.5	1.4	20	17.5	13.5	4.0	23	20.0	14.0	6.0	30
Nonwar	29.2	21.3	7.9	27	21.1	13.2	7.9	37	19.6	10.7	8.9	45

Estimates, subject to revision, Bureau of Labor Statistics and Bureau of Employment Security.

found at one plant, arrangements, it is said, will be made to transfer the workers to operations where labor is scarce.

Earlier and in an effort to co-ordinate local efforts, WMC established in ten localities Area War Manpower committees, representing management and labor. The first and most successful to date is in Baltimore, where progress has been made in recruiting and training large numbers of women and in the transference of skilled workers from nonessential to essential industries.

Generally speaking, industry so far has managed to get along, through intensive training programs, easing of employment restrictions, ingenious arrangement of working shifts, and so forth. Some of its success, admittedly, has been at the expense of other fields of employment, and in this, where war plants benefited, the government lent approval and even encouragement, certainly as it applied to the attracting of labor from the nonessential industries.

However, high wages attracted men from the farms and mines, where the draft and voluntary enlistments already had made heavy inroads. So WMC in its first drastic move a few months ago ordered workers in the mining and lumber industries of 12 western states to obtain "certificates of separation" from the United States Employment Service before taking jobs in other industries. Late in the fall WMC issued a directive virtually freezing employes in the dairy, livestock and poultry industries against transfer to the armed services or war industries, and only last month in Detroit, with the acquiescence of management and of labor, took steps that, in effect, virtually froze 660,000 workers in that area in their jobs.

Whatever powers the WMC may now possess, there are those who believe that the whole problem cannot be effectively solved short of the enactment of a selective service law for workers, based on the principle of the Selective Service Act. While, so far as is known, Chairman McNutt has not expressed himself publicly on this point since his grant of broader power, he has previously expressed favor of such a law. On the other hand, around that time his management-labor policy committee, in a report to the President, suggested a voluntary program, calling for more effective co-ordination of agencies dealing with the manpower problem. Likewise, the Tolan investigating committee, in the House, favored a voluntary solution, and Major-General Lewis B. Hershey, director of the Selective Service System, thought the job might be accomplished with a marginal 10 per cent of the problem possibly standing in need of new legislation.

So far the President has been disposed to try voluntary rationing of labor first. He suggests, as a part of this program, that workers stop moving from one war job to another as a matter of personal preference; that employers

stop stealing labor from one another; that older men and handicapped persons and more women be used, that a stop be put to wastage of labor in all nonessential activities; and that "prejudice and practice" of some industries which bar women, negroes and old men be given up. He also suggested to employers in civilian industry to encourage the transfer of skilled workers to war jobs by guaranteeing re-employment without loss of seniority. However, he made clear that if a voluntary system did not work, he would ask for compulsory legislation.

Many believe that much can be done first, such as the more judicious selection of men for the armed services; following the President's suggestions, as outlined above; termination of many union rules and practices to compel the creation of additional jobs and of excessive initiation fees; and the elimination of the basic 40-hour week. If this weekly schedule were changed to 48 hours, the available labor supply at current wage rates would be increased 20 per cent. This, it is claimed, would be the equivalent of adding 10,000,000 workers at existing hours.

At present the average work week is less than 43 hours, with those in the nondurable goods industries generally still working less than 40 hours per week. In several of the basic war industries schedules are short of 48 hours, with the steel industry around 40, aluminum approximately 45 and aircraft less than 47.

Administration and labor leaders take the position that there is no limitation on hours; that if longer hours are necessary all employers have to do is pay the extra overtime pay. This, of course, is being done in many instances, and especially where the costs can be passed on to the government, as in war work. However, it is emphasized that where this charge can not be passed along, a short week inevitably results, and that regardless of whether the short week is in a war plant or a nonwar plant it means an important loss to the country, as the extra help required is being diverted from the war effort.

Last spring Congress, stirred by feeling throughout the country, started to change the 40-hour law, but gave up in the face of strenuous resistance from the Administration. Donald M. Nelson around that time voiced disapproval of a change. "To abolish the 40-hour week," he said, "would not bring any greater production or more sustained effort in war industry. On the contrary, I believe that such action would have a harmful effect on war production." He explained that a change would cre-

(*Please turn to Page* 438)

Specially-trained women operate giant cranes at the Ford Willow Run plant. The girl above previously was a riveter

—o—

Below, another girl transports cut strip on an electric ram truck at Carnegie-Illinois Steel Corp. plant

Labor-management committees, formed in more than 1700 plants, encouraged ideas for increasing wartime production. At left, workers whose ideas have been accepted are receiving Certificates of Individual Production Merit, highest honor bestowed by the WPB

—o—

In the Monarch Machine Tool Co., Sidney, O., these women, below, prove their adeptness in operating lathe

INDUSTRY

Direct

Construction proceeds 24 hours a day on the new Dodge Chicago plant, "world's largest manufacturing unit". Shown above is a night scene; all lights are on the plant's property

—○—

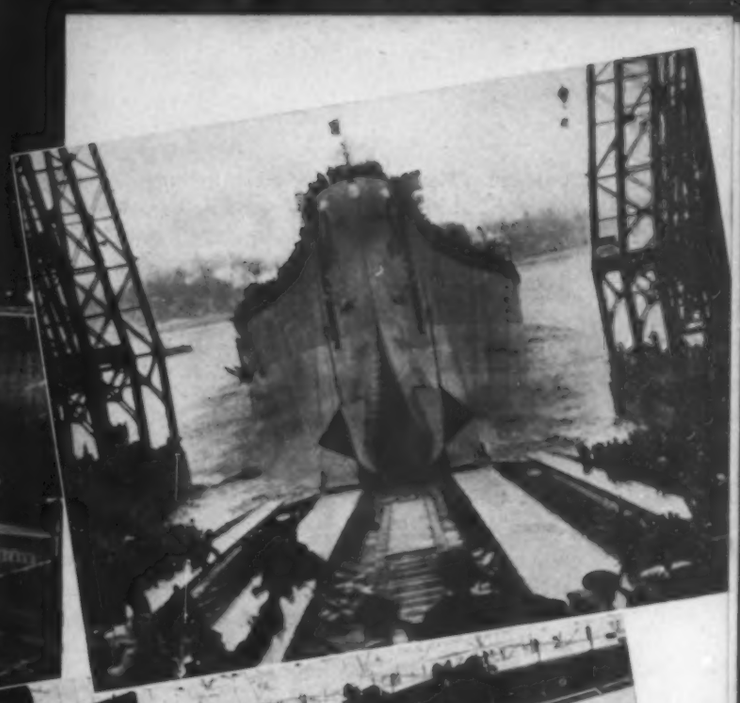
Pom Poms on guard against enemy aircraft in the Pacific, left

—○—

All-welded M-4 tanks await inspection, lower right, at a Fisher Body plant

—○—

Heaviest battleship ever built, the U. S. S. New Jersey, slides down the ways at Philadelphia Navy Yard, above right, several months ahead of schedule. While details are a military secret, the vessel incorporates the lessons learned at Pearl Harbor



INTENSIFIES

War Materiel Production

Shipbuilders now taking 20 per cent of steel output. Farm and railroad equipment builders hindered by material shortages. Structural fabricators face lean year

ACCENT in 1943 will be on the production of direct implements of warfare and the machines and materials necessary to make those implements.

While 1942 witnessed a tremendous output of direct war materials—nearly 50,000 planes, 32,000 tanks and self-propelled artillery, 17,000 antiaircraft guns, and 8,200,000 tons of merchant shipping a large but undisclosed tonnage of naval ships and great quantities of ordnance material—a large part of the year's effort was spent in building new facilities and converting existing plants to war work.

The conversion and construction phases of the program have been largely completed, or soon will be, and the basic metalworking industries this year will devote their full energies to making those things which can be thrown at the enemy.

The goal for direct munitions output this year has been raised sharply over 1942.

Attainment of this goal will be difficult, but not im-

possible. Consider merchant shipping. At the beginning of last year, yards and ways and machine shops had yet to be constructed. Plate capacity had to be expanded. Skilled workers had to be trained. Know-how had to be acquired by supervisors and management. Time-saving devices had to be initiated.

Much of this was accomplished during the year, while the industry was exceeding the 8,000,000-ton goal established in January.

However, all the basic industries will be confronted with three major problems—manpower, materials and machine tools.

The machine tool industry which has been establishing remarkable production records for the past several years still has a huge backlog, estimated at about eight months. Most of the tools on order are critical, and as they are delivered demand for other critical tools is certain to arise, due to changes in the type of munitions needed.

Another difficulty of the industry is that the backlogs are unevenly distributed. War Production Board now is acting to level out these backlogs to expedite deliveries.

Manpower and materials shortages are obvious. Institution of the Controlled Materials Plan should send the critical materials to the end uses most needed, while the drastic controls established over labor under the War Manpower Commission and the use of manning tables is expected to result in a more orderly distribution of the available supply. Training programs still in progress for women, handicapped workers, and others not normally included in the labor force should add many new skilled and semiskilled laborers.

Some Industries Face Lean Year

While many industries will be working far beyond what once was considered their capacities, others are in for a lean year. The construction industry, for example, will be hard hit. Most of the wartime construction has been completed or will be early this year, and steel will not be available for civilian projects. Some of the war projects projected or started are being canceled to divert materials into direct *materiel*.

Railroads, carrying a record burden of traffic, have been hampered in new equipment building and replacements by limitations on steel and other metals supply. Many railroad shops, however, are building tanks, guns, gun carriages, shells, bombs and similar items and undoubtedly will have all the work of this type they can handle.

The agricultural implement industry's problem is akin to that of the railroads. With demand for farm produce far exceeding supply, the amount of steel allowed implement makers has been progressively reduced. Coupled with this has been an increasing manpower shortage as farm youths were drawn into the armed forces.

Many of the implement manufacturers, however, have been in a position to assume large war contracts.

Comprehensive reviews of these basic, and related, industries will be found on the following pages:

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Machine Tool Builders

Redouble Efforts to Clear up Backlogs

By GUY HUBBARD
Machine Tool Editor

AT THE time of the Japanese attack on Pearl Harbor, the machine tool industry in the United States already had expanded its output to approximately five times its normal peacetime production. Great though this effort had been—under the demands of Lend-Lease and what up to that time had been called our National Defense Program—it immediately became evident that the two-ocean war into which our country finally had been plunged, called for still more extraordinary efforts on the part of the machine tool industry.

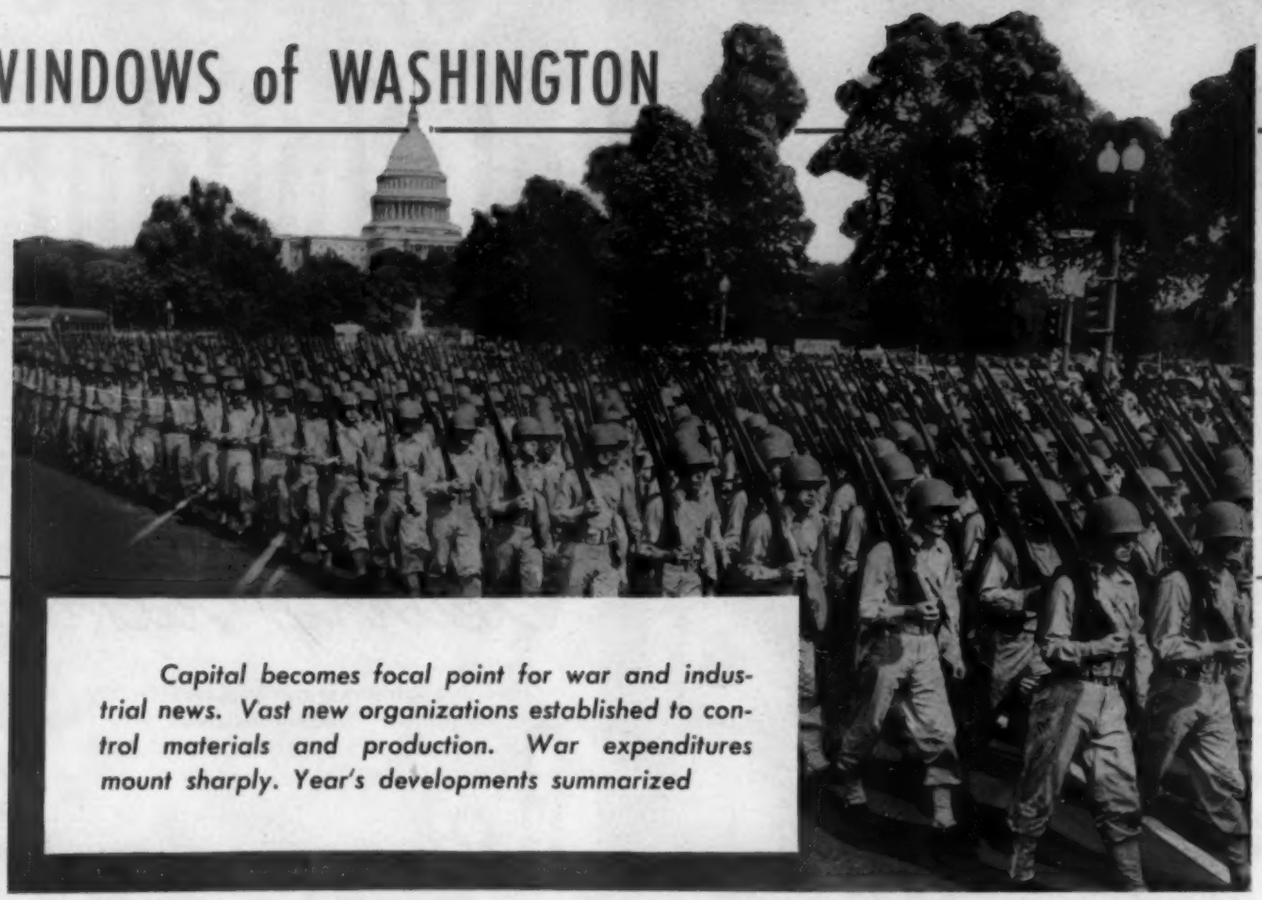
In the words of George H. Johnson, at that time president of the National Machine Tool Builders' Association, and now director, Tools Division, War Production Board: "Since Pearl Harbor the machine tool industry has in effect become part and parcel of the armed forces of the United States. Today our industry literally is engaged in a battle with the enemy. The pace and tempo of this war constantly is accelerating and we on the production battle line must keep pace with the ever-growing requirements of the men on the fighting fronts."

A survey of the situation by government authorities about the first of the year 1942 indicated that further expansion of at least 25 per cent in machine tool output immediately was imperative. Pressure was put on to hasten completion of plant additions. This program has during the year amounted to over $80,000,000 and has

(*Please turn to Page* 403)

This 5-foot conventional type of vertical boring mill, slated for disposal by a Detroit jobbing tool shop, was found to be just the tool for touching up the inside of a dynamometer starter to provide better clearance. Note how a standard type of electric grinder, with 6-inch wheel, has been mounted on one tool post of the boring mill, permitting operator to remove as much as 0.030-*inch from the inside of the stator mounted on the rotating table. A novel setup, but one of the few ways the job could be done quickly and efficiently*

WINDOWS of WASHINGTON



Capital becomes focal point for war and industrial news. Vast new organizations established to control materials and production. War expenditures mount sharply. Year's developments summarized

Soldiers of freedom march down Pennsylvania avenue past the White House, symbolic of America's battle for the four freedoms emphasized in the Atlantic Charter

WASHINGTON, always an industrial news center, has been multipled in importance in the 12 months just ended.

The myriad regulations and controls promulgated by the war production, price control and conservation agencies have become controlling factors in the life of every business and every individual.

These, of course, largely have been superimposed during the past year on the normal business of government.

Visitors to the capital find it difficult to comprehend the extent of the organization that has been built up here. Even native Washingtonians who have seen the structure rise step by step find it almost incredible.

It appears likely that this vast organization must be retained for the duration of the war; then, perhaps, it will be replaced with other planning agencies for the reconstruction period.

As the new year begins, the slate in Congress is clean. It is starting not only a new session but a new Congress. Bills and resolutions are held over from session to session, but when a new Congress begins, everything in the old Congress is "dead." There is certain to be during the coming year much legislation of vital interest to the steel industry along with every other industry of the country.

Last year Congress passed a bill which was signed by the President on Feb. 6 to amend section 124 of the internal revenue code to simplify the procedure in connection with amortization of certain facilities.

On March 13 the President signed a bill to suspend the effectiveness during the emergency of tariff duties on scrap iron, scrap steel, and nonferrous metal scrap. This law provides that no duties or import taxes should be levied, collected or payable under the tariff act of 1930, as amended, with respect to "scrap iron, scrap steel, relaying and re-rolling rails, or nonferrous metal scrap entered for consumption or withdrawn from warehouse for consumption during the period beginning with the day following the date of the enactment of this act and ending with the termination of the unlimited national emergency proclaimed by the President."

Congress also, during the past year, passed an act authorizing Canadian vessels to transport iron ore on the Great Lakes. Such a bill previously had been enacted for the year 1942, but it was further extended by a bill signed by the President Aug. 1, through which this traffic by Canadian vessels would continue for the duration.

Comparatively few bills were introduced in either branch of Congress last year dealing with steel. One, HR 2076, offered by Representative Burdick, North Dakota, provided for public ownership of the steel industry. This was a long, complicated bill, was referred to the House Ways and Means Committee, but hearings were not even held.

The delegate from Alaska, Anthony J. Dimond, introduced a bill, HR 96, which provided for a tin survey in Alaska. It was referred to the Committee on Mines and Mining, but no hearings were ever held on it.

Senator McCarran, Nevada, introduced two bills granting loans for the development of minerals. One of the bills was referred to the Committee on Mines and Mining, and the other to the Military Affairs Committee.

During the present fiscal year, ending June 30, 1943, United States war expenditures will amount, in round numbers, to 74 billion dollars, with the nonwar expendi-

Among troublesome problems faced by governmental authorities after Pearl Harbor was the acute shortage of rubber. Many were the suggested remedies. Here a group of Congressmen bounce a synthetic rubber ball, evaluating it for practical uses

tures totaling approximately 4 billions. In the latter category there is a reduction in expenditures for nonwar expenses of 35 per cent from the 1939 peak.

The 1943 federal dollar has been divided into 94.8 cents for war expenditures and interest on the public debt, and 5.2 cents for nonwar expenditures. In announcing this figure the administration has pointed out that the estimated 4-billion-dollar expenditure for the current fiscal year represents a cut of nearly a billion dollars from those of last year. The 74 billion dollars for war expenditures during the present fiscal year represents the latest estimate of what is expected to be actually paid out by the Treasury during the 12-month period. This figure is an increase of between 15 and 20 billion dollars over the war cost estimate of a year ago.

War Expenditures Mount Impressively

These figures, announced in a recent message to Congress, also accounted separately for the activities of government corporations and credit agencies whose expenditures for war purposes during the present fiscal year were estimated at a net of 4 billion dollars. For nonwar purposes, their income exceeded outgo by 59 million dollars, which has been described as profit.

For war expenditures the report listed these figures since 1932:

1932	$797,000,000	1938	$ 1,000,000,000
1933	721,000,000	1939	1,250,000,000
1934	578,000,000	1940	1,700,000,000
1935	726,000,000	1941	6,300,000,000
1936	940,000,000	1942	26,000,000,000
1937	967,000,000	1943	74,000,000,000

First defense organization was the Advisory Committee of the Council of National Defense of which Edward R. Stettinius Jr., United States Steel Corp. chairman, was the chief. He was succeeded by William S. Knudsen. The council subsequently became OPM, and finally WPB, now presided over by Donald M. Nelson.

Since the first of the year there have been four chiefs of the WPB Iron and Steel Branch including the incumbent. They were: C. E. Adams, chairman, Air Reduction Corp., who was chief of the branch from Dec. 11, 1941 to May 25, 1942; Reese Taylor, president, Union Oil of California, from May 25 to Aug. 31; David Austin, Carnegie-Illinois Steel Corp., who was acting chief from Aug. 31 to Sept. 21; and H. G. Batcheller, Allegheny-Ludlum Steel Corp., since Sept. 21.

Immediately following Pearl Harbor, OPM and OPA assumed closer control over materials and prices.

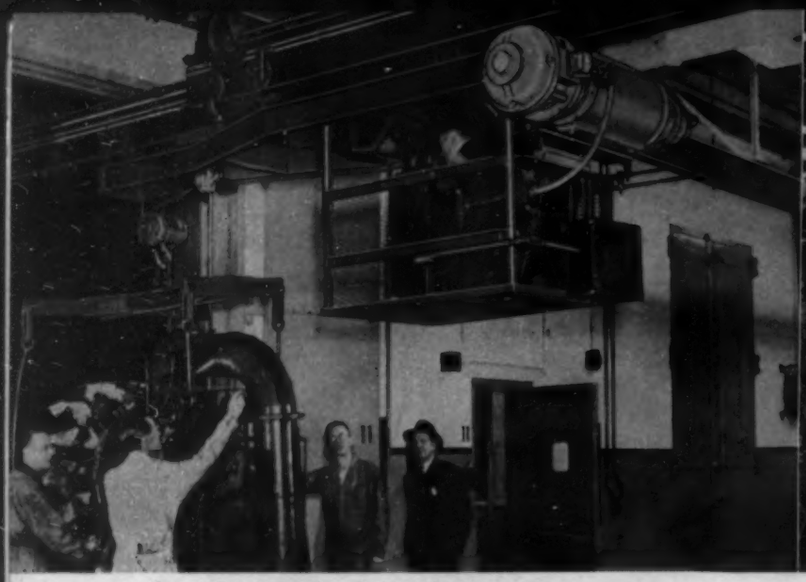
It was at that time also that President Roosevelt set up production goals of 185,000 airplanes, 120,000 tanks, 18,000,000 tons of merchant shipping, and 55,000 antiaircraft guns for 1942 and 1943. With the greatly increased war needs, those figures, which looked fantastic when announced, have gone into discard.

It was apparent at the beginning of 1942 that there would be great hardship and dislocation in industry; that occurred during the year, especially among small plants.

Early in the year the President selected Donald M. Nelson, formerly of Sears-Roebuck Co. and a man of wide business and Washington experience, to head WPB. Mr. Nelson was in Washington for some time during the old NRA days and made many valuable friendships which have proved of much service to him since. One of these contacts was Leon Henderson, who has close connections at the White House, and who has several times during the year gone to bat for Mr. Nelson.

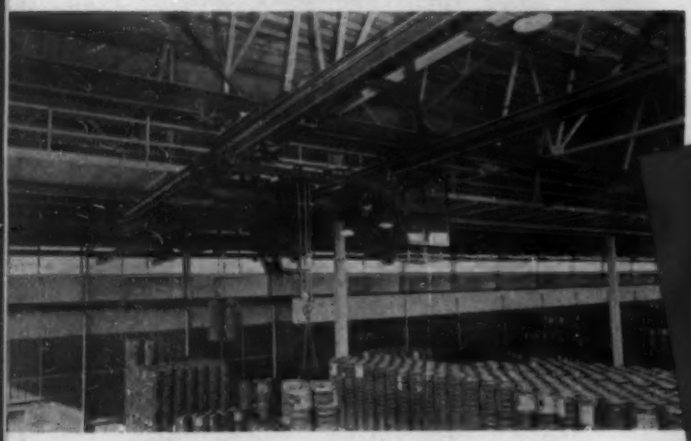
Mr. Nelson has been criticized, but general opinion among Washington officials is that he has done a creditable job.

When Mr. Nelson assumed control of the WPB, he declared that 1942 was the critical year in the production of war materials and insisted the war could be won or lost on the production front. Output of these materials increased phenomenally and the sights were raised on the production program several times. Early last spring most general and blanket WPB priority orders were revoked or allowed to expire in a revision of the priorities sys-



Special telescoping bridge is thrust into cell for accurate spotting.

Electric cranes furnish over-all coverage for quick transfer of large assemblies.



Twin bridge cranes permit high piling for increased use of warehouse space.

Gantry cranes provide power operated handling service for ingot grinding.

Two level gravity system sets up constant bank of material for machines.

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Ends floor deterioration.
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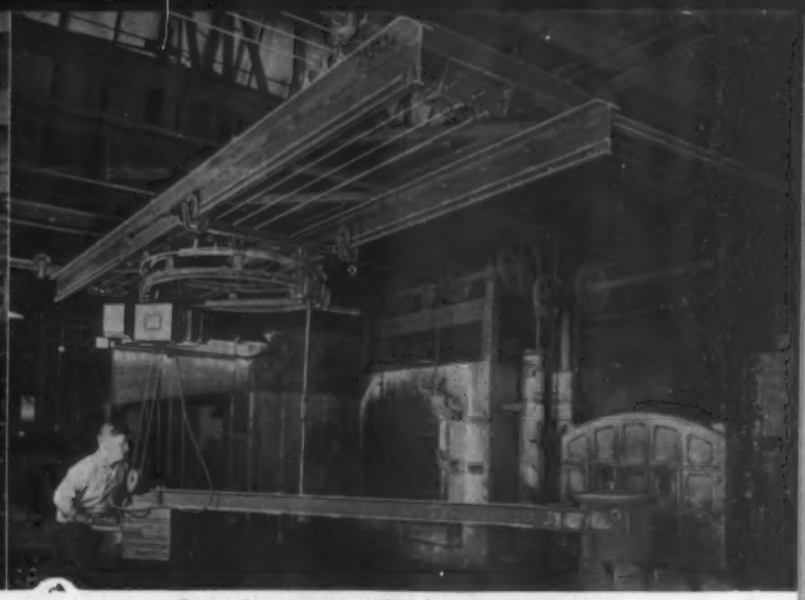
13102 ATHENS AVENUE

MonoTractor cab propels train of carriers, eliminating excessive wear on floors.



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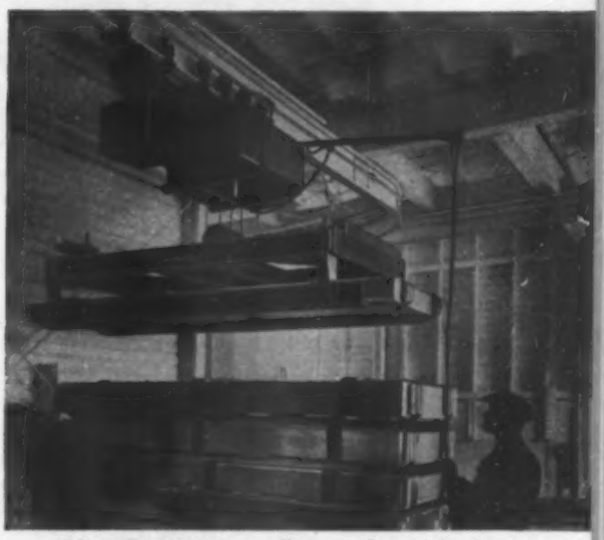
From their specialized experience in solving overhead handling problems in every industry, American MonoRail engineers can suggest simple methods for improving operations in your plant.

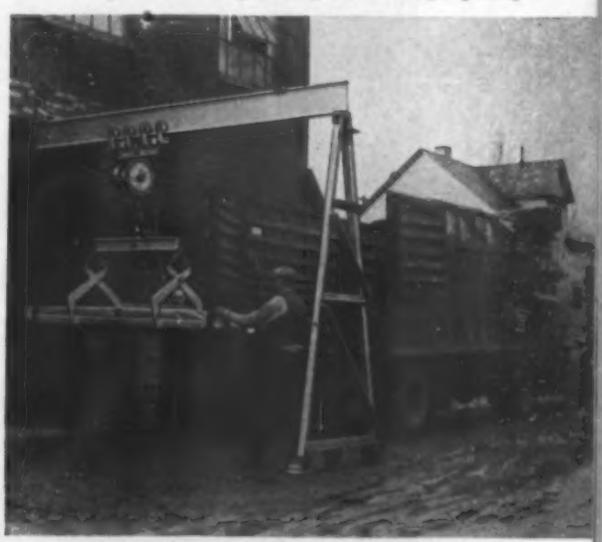
Their recommendations often show increased production from skilled help by merely eliminating the lifting and carrying labor of handling jobs.

Such suggestions, when made early in the planning of industrial projects, often save valuable time and material. They have been requested and welcomed by nationally known architects and engineers.

We therefore place the complete facilities of our engineering staff at the disposal of any company planning to build or expand.



MonoTractor moves 5-tons of steel by fingertip control. Special grab for high piling.



Unloading steel direct to storage. Crane retracts against building above doorway.

AMERICAN MONORAIL

OVERHEAD HANDLING EQUIPMENT

MONORAIL

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WRITE FOR Blue Book illustrating hundreds of MonoRail Installations.

tem and more companies were brought under the Production Requirements Plan and greater emphasis was placed on end-use of materials.

One of the matters of interest to the steel industry has been that of steel expansion. As it stands at present, the steel expansion program is expected to be completed not later than June 30 this year.

June 30 last year, WPB expansion experts were asked to prepare a report giving the exact status of the program as authorized by WPB and the President Sept. 30, 1941. Since that time no new major expansion has been undertaken. There have been many additional and smaller projects running into thousands of dollars, but none in the millions as previously.

When the last official report was made, the expansion program which had been authorized amounted to 10,762,000 ingot tons. Because of the critical steel shortage at that time, expansion experts were required to reduce the program. It was cut 10 per cent and recommendation was made to complete 9,710,000 tons.

The directive for the official report was issued by A. I. Henderson, director of WPB Materials Division. He asked that recommendations be made as to which plants in the projected program should be pushed as rapidly as possible, which deferred, or abandoned.

Inasmuch as steel expansion requires plates, structurals, and other materials and would interfere with the production of mill-end products during 1942 and the first six months of this year, it will be limited to that part of the directive which requires that complete projects be deferred which would not be completed before July 1 of this year, giving consideration to the present status of the program.

It was found necessary by WPB officials to service the ingot capacity with 3,000,000 tons of additional pig iron capacity because of the scrap shortage. This 3,000,000 tons was part of the 11,000,000 tons provided in the expansion program.

Consideration was first given to installing new facilities in existing plants. This method had the advantage of an earlier start on production, low cost, more efficient operation and better economic value after the war.

Difficulties experienced in financing experiments under this method with public funds somewhat restricted its general application. A special committee of the iron and steel industry on steel expansion, consisting of practical men in the industry, reviewed the program from time to time for the purpose of establishing construction schedules. The entire steel expansion program was reviewed before it was finally approved by the Clearance Committee on Plant Facilities of the Iron and Steel Branch, together with the special steel consultants in the branch and representatives of the Army-Navy Munitions Board.

Price fluctuations in the iron and steel industry recently have been relatively small according to figures compiled by the Office of Price Administration. Slight increases in prices for particular components of the industry resulted last year from modification of various schedules and regulations as well as from relief granted specific firms in the form of higher ceilings for their products. OPA of-

Typical of the congestion in wartime Washington is this crowd pouring out of the Navy Department building as the day ends. Housing constituted one of the capital's major problems

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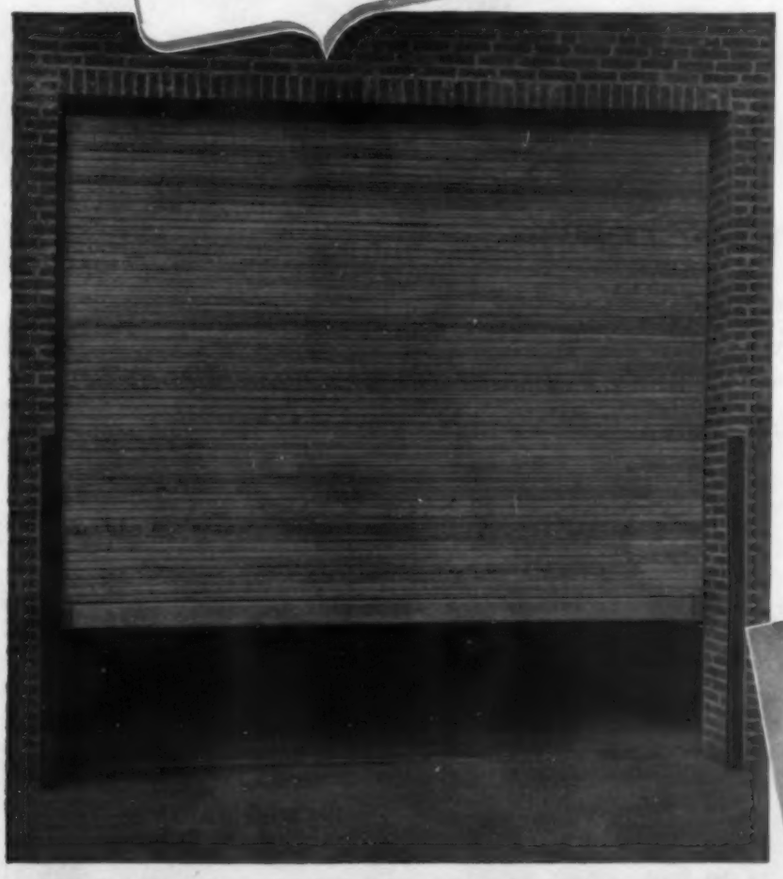

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CONE AUTOMATIC MACHINE CO., INC.
WINDSOR, VERMONT, U. S. A.

A heroine of Bataan and a hero of Midway meet at the Capitol, Washington, to join in Pearl Harbor Day ceremonies, prior to beginning a journey to speak to war workers in more than 1000 plants. WPB's War Production Drive Headquarters selected them and others to stimulate interest in meetings held under auspices of Labor-Management committees

ficials state, however, that such increased prices were probably more than offset by the issuance of new schedules for certain products and the price regulations effective under the General Maximum Price Regulation.

A large segment of the industry faces increased costs as a result of three basic factors:

1. The wage decision of National War Labor Board in the "Little Steel" case and other wage increases.
2. Shortage of water transportation, forcing the industry to rely to a greater extent upon higher cost rail transportation.
3. Lack of supply of high-grade scrap to meet standard product requirements.

Figures compiled by OPA indicate favorable profit prospects for most firms, and OPA experts insist that considerable absorption of increased costs could take place without creating hardship. There was also prospect that lower unit cost would result from new facilities and near-capacity operations. It is insisted by OPA that the prevailing price structure is not seriously threatened by increased costs.

Some pressure against the price ceilings from buyers developed as a result of competition for the limited supplies. This pressure, it is said, is gradually being removed through improvement of allocation technique of WPB.

OPA Determined To Maintain Steel Prices

During the past year one of the most difficult problems faced by OPA Price Stabilization Division was that of maintaining steel prices. This problem was recognized as early as the summer of 1940 when Leon Henderson urged that steel capacity be increased by many million tons. This recommendation was not adopted at the time, but it came along later when WPB officials recommended it and it was approved by the President.

Consideration was given during the spring of 1941 to the need for additional steel production capacity, but the construction of new plants was postponed for a time by a dispute over the size of the prospective needs.

Early in the war effort OPA issued its Schedule No. 6, setting maximum prices for iron and steel products. By establishing these prices OPA officials insisted that they laid at rest a greater number of unsettled expectations than any other single industry price regulation could have done. There were regulations directly affecting numerous other related industries and products which, by its very scope indicated that OPA was determined to keep the level of prices on the steadiest possible keel.

During the past year WPB issued many directives and orders of interest to the steel industry:

The Director of Priorities issued an amendment to General Preference Order M-42 affecting sheet steel for steel drums to be used for overseas shipment, so that hot-rolled sheet steel of any gage might be used for the manufacture of sheet steel drums and so that such drums might be used for all kinds of products to be shipped overseas.

The Priorities Division issued an amendment to Preference Rating Order P-68, extending to Canadian iron and steel producers the same high ratings available to domestic mills in obtaining materials necessary for repair, maintenance and operation.

Priorities assistance was granted for deliveries of steel and welding electrodes used in the operation of training classes for welders under the United States Office of Education.

Announcement was made by the WPB Division of Industry Operations that priority assistance would not be granted for the construction of air-raid shelters in the United States.

Steel and Copper Allotted to Railroads

A program was approved calling for allotment of 900,530 tons of steel and 2250 tons of copper to the country's railroads during the first quarter of last year for maintenance of way and structures, provided the requirements could be met without interfering with shell production.

Announcement was made that users of pig iron and scrap were not relieved of the necessity of filing Form PD-70 with the Iron and Steel Branch, by the use of any other forms relating to iron and steel scrap.

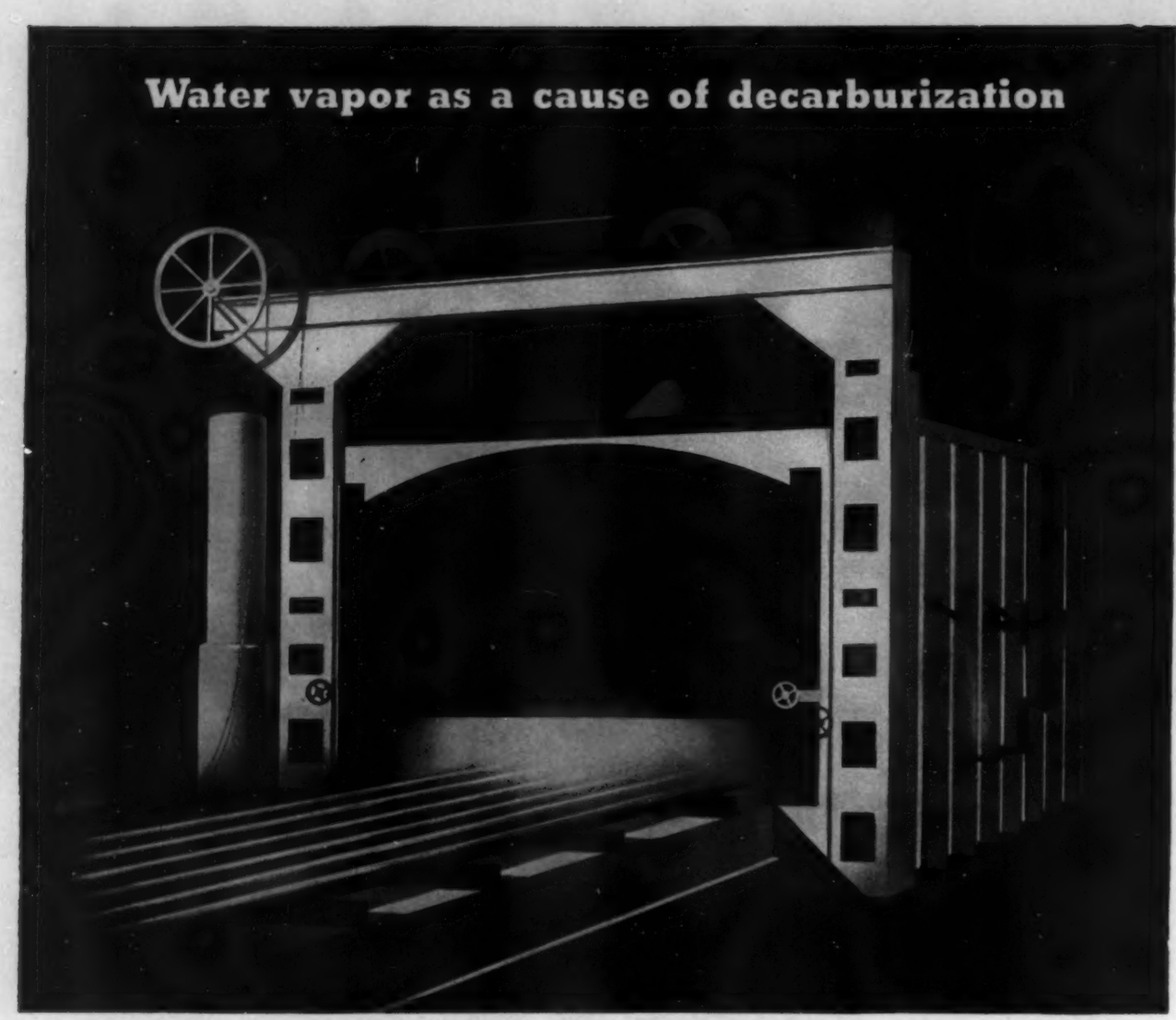
The Iron and Steel Branch insisted that the industry must take the lead in getting users to change design to take advantage of added capacity from strip mills.

Steel producers supplying the petroleum industry were ordered by the director of industry operations not to ship oil country casing, tubing, or drill pipe, or to ship line pipe except on orders bearing a preference rating of A-9 or higher.

A complete allocation system for shot and bullet core steel was set up in Order M-21-f. An order was issued

(*Please turn to Page* 396)

Water vapor as a cause of decarburization



Information supplied by an Industrial Publication

Experience shows that the decarburization of steel in special atmosphere heat treating furnaces can often be traced to water vapor formed in the furnace.

Given knowledge of the conditions that cause it, and sure means of detecting its presence, elimination of water vapor can be accomplished by taking appropriate steps.

The formation of water vapor is due to the effect of high temperature on the composition of the furnace atmosphere. Compositions that apparently have proper constituent ratios when they leave the preparation unit may, and almost always do, change at operating temperatures.

The most important change is that known as the "water gas" reaction. If there are CO_2 and H_2 in the atmosphere gas, the following reaction will take place:

$$CO_2 + H_2 = CO + H_2O$$

Under such conditions, a "bone dry" atmosphere can readily produce H_2O in the furnace, and thereby cause decarburization.

Manufacturers of special atmosphere units are giving increasing attention to the best methods of avoiding the presence of CO_2. They will be glad to suggest the best method for individual cases.

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.
MOLYBDIC OXIDE BRIQUETTES • FERROMOLYBDENUM • "CALCIUM MOLYBDATE"

Clima[illegible]-[illegible]-[illegible]m Company
500 Fi[illegible] Ave[illegible] · [illegible]ew York City

MOLY

MIRRORS of MOTORDOM

By A. H. ALLEN *Detroit Editor, STEEL*

General Sherman tanks roll off the Chrysler assembly lines in enormous quantities at the Detroit Tank Arsenal. Eleven of the company's plants send parts to the arsenal where the units are assembled on the lines pictured above and on others in another part of the building

Automotive industry producing war materials at rate of 75 per cent above dollar level of peacetime peak. Output surprises even most optimistic planners. Covers virtually entire gamut of fighting weapons

DETROIT

FABULOUS production achievements have been commonplace in the history of the automotive industry, not the least noteworthy being the manufacture of 86,000,000 motor cars and trucks in 42 years of steadily rising output. In 1900, which for all practical purposes may be considered the birth-year of automobiles, a total of 4192 passenger cars was assembled. How this meager total grew, with attendant ups and downs of course, to the 5,000,000-car years of 1929 and 1941 is a tale which industrial romanticists can really sink their teeth into. The world has seen nothing like it.

But even exceeding the drama of this four-decade wonder story is the twelve-month remolding of the industry from the world's greatest producer of transportation equipment to the world's mightiest fashioner of armaments. It is a demonstration of flexibility of mentality, plant and equipment, together with voluntary co-operation and integration, which is at once difficult to comprehend and yet is the hope of a postwar economy in which the established American way can and will prevail.

Never in its long and eventful history has the motor industry seen its passenger car production shut off completely as it was last spring when the demand for armaments made it apparent that all-out effort by all industries was imperative, and conversion from peacetime to war products essential. There have been model changeover periods and short depression intervals when car output came to a halt, but never had government edict put the lock and key on assembly lines, in fact ripped them out of place to make way for new equipment for fashioning a war machine.

True, the automotive industry had been "dabbling," so to speak in war products, or defense equipment as it was then called, since 1939, but until the fateful day of Pearl Harbor, this work was just a sideline, although it was building up constantly to an important position.

Car production lingered on for three months, principally because of the necessity of using up "floats" of parts and subassemblies, but from Dec. 7, 1941, the motor industry rolled up its sleeves all the way for the biggest task of its career. How well the job has gone can be appreciated from a few general statistics.

Since Pearl Harbor, automotive plants—and this covers

Heavy antiaircraft barrels are manufactured in quantity in this Chrysler Corp. plant

several hundred allied companies as well as the principal builders of motor cars and trucks—have delivered tanks, military vehicles and parts equal in dollar volume to the cost of equipping 57 armored divisions with their balanced complements of 3314 motorized vehicles each. They have delivered aircraft fuselage sections, engines, propellers and parts equal in dollar volume to 50 squadrons of war planes, each consisting of 15 heavy bombers, 30 medium bombers and 90 fighters. Their output of marine equipment totaled enough to purchase 70 submarines and 650 motor-torpedo boats. And in addition, they supplied millions of dollars worth of guns and ammunition, range finders, pontoons, helmets, shells, bombs, and a hundred other implements of warfare.

Altogether this outpouring adds up to nearly 20 million dollars worth of war goods a day, or a current annual rate (as of late December) of $7,000,000,000, which is 75 per cent above the dollar level of the industry's best peacetime year.

For a graphic representation of how the industry's output of war products mounted during the year, an accompanying chart shows the trend of dollar volume shipments by General Motors plants, equivalent roughly to 40 per cent of the entire industry, stacked against similar shipments of peacetime goods in the year previous.

So successfully did the motor industry meet its schedules of war production during 1942 that in many cases it surprised even its own most optimistic planners. By the end of the year war goods were being delivered at four times the rate of 12 months earlier. The material supplied the armed services went a long way toward making up the deficiencies prevalent in all types of weapons when the Japs struck, far enough at least so that basic requirements were fairly well filled and the delicate job of gearing production to military strategy became more important.

By December, the industry was beginning to understand the four essential phases of modern war production: First the tooling or preparation stage, during which virtually unlimited orders for a wide variety of implements were digested and new facilities built or arranged to handle mass production; second, the production stage, during which quantity output is the chief end, always tempered by the necessity of frequent though minor changes in design; third, the reorientation of production so that supply can be scheduled on the basis of battlefront needs; and fourth, the as-yet little explored phase of effecting continuous improvement in the products being manufactured.

Broadly speaking, we are now in the third stage, in which it becomes apparent that a reshuffling of production schedules is necessary to concentrate on certain products and ease up on others—airplanes before tanks, shipping before heavy guns, etc. The fourth phase should become more important in the current year. It would, of

AUTOMOBILE PRODUCTION BY MONTHS

	1929	1939	1940	1941	1942
Jan.	422,538	356,962	449,509	524,073	260,012
Feb.	497,705	317,520	422,225	509,332	154,315
March	626,076	389,499	440,233	533,878	114,698
April	663,811	354,286	452,432	489,856	* 96,000
May	636,250	313,248	412,510	545,355	* 90,000
June	567,424	324,253	362,565	546,278	*100,000
July	518,301	218,600	246,172	468,897	* 91,000
Aug.	512,842	103,343	89,866	164,793	* 86,000
Sept.	429,729	192,679	284,603	248,751	* 85,000
Oct.	394,540	324,689	514,357	401,369	* 93,000
Nov.	226,997	368,541	510,973	373,892	* 77,000
Dec.	125,502	469,118	506,922	302,518	* 85,000
	5,621,715	3,732,718	4,692,367	5,108,992	*1,231,000

**Estimated by Ward's Automotive Reports.*

INDUSTRY SHOOTS PRODUCTION MINUTES

MICROHONING MAKES MORE HITS

★ save time
★ save metal
★ save cost
★ improve quality
WITH MICROHONING

Micromatic Hones have lowered the time required for final sizing and surface finishing operations from days and hours to minutes and seconds.

Microhoning saves TIME—COST—METAL REMOVAL—MANUFACTURING COST—AND IMPROVES PRODUCT QUALITY which combined means more target hits in the tough service of WAR.

Micromatic Hones range from sizes for bores .303" to 25½" in diameter—from ¼" to 900" long. They generate geometrical and dimensional accuracy, uniform size and any desired surface finish with minimum removal of stock.

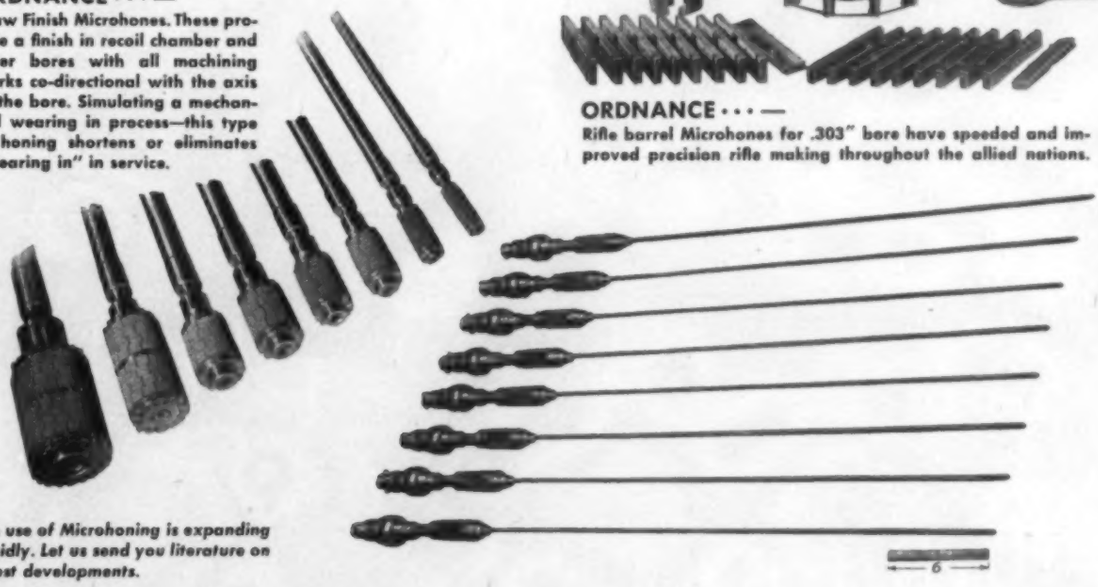
MICROMATIC HONE CORPORATION

8100 SCHOOLCRAFT MICRO MATIC **DETROIT, MICHIGAN**

DIESEL • • • —
24" Microhone for Diesel engine liners. Extra miles per hone in submarines, mine sweepers and similar marine engines require the controlled accuracy provided by Microhoning.

ORDNANCE • • • —
Rifle barrel Microhones for .303" bore have speeded and improved precision rifle making throughout the allied nations.

ORDNANCE • • • —
Draw Finish Microhones. These provide a finish in recoil chamber and other bores with all machining marks co-directional with the axis of the bore. Simulating a mechanical wearing in process—this type of honing shortens or eliminates "wearing in" in service.



The use of Microhoning is expanding rapidly. Let us send you literature on latest developments.

New low silhouette Army trucks are pouring from the Dodge truck plant near Detroit by the thousands. Above are a few awaiting shipment

course, be a discredit to the armed forces to say that improvements were not being made continually in war products even last year, but it is true that industry's engineers were launching into the production of things they knew little about from the standpoint of operation in the field. Now, however, more than one company has skilled technical observers "out front" who report regularly to headquarters. Manufacturing talent will be translated swiftly into terms of war products more effective in the field.

To show the transition from peace to war, let us sketch briefly the change in one of the largest corporate groups in the motor world—Chrysler. In peacetime, Chrysler was the second largest producer of passenger cars and trucks, with 23 manufacturing plants in the U.S., normally employing around 80,000. Chrysler plants are now at work on better than 30 major war contracts, including medium tanks (of which it is the largest producer in the country), tank engines, 40-millimeter antiaircraft cannons, nose and center sections for medium bombers, ammunition of several sizes, trucks, tank destroyers, reconnaissance cars, radio cars, troop transports, weapon carriers, carryalls, ambulances, aircraft engines, wings for dive bombers, airplane landing gears, gyro-compasses, marine tractors, air-raid sirens, air-raid firefighting equipment and Navy pontoons.

Better than 86 per cent of Chrysler's regular automobile and truck-producing machine tools have been converted to war work. Thousands more have been ordered, some delivered. When all war contracts are in full production, a total of 30,000 machine tools will be in operation. Production will be at an annual rate of $2,000,000,000 (better than twice the normal rate). Anticipated employment requirement will be about 145,000.

Latest Chrysler war project is the vast new Dodge-Chicago plant for machining, assembling and testing one of the largest airplane engines ever placed in mass production. Details of the plant have been carefully restricted, but it will be one of the largest industrial units

High-explosive and armor-piercing shells by the millions are supplied by motor companies and allied plants. Below is one step in processing 75-millimeter armor-piercing shot, workman at the right stamping the lot number on the shell body while operator at left paints the cap or "windshield"

Sub Propeller Shafts Needed Quickly!

Story of How Ryerson Ingenuity Saved Five Weeks

URGENTLY needed at a distant shipyard were fourteen forged submarine propeller shafts that must pass Navy specifications.

Forgings were specified, but none could be secured in time.

Quickly available in Ryerson stocks were cold rolled bars—the right size—but in five different analyses.

Navy Inspectors were skeptical. Could Ryerson heat-treat and assure uniform physicals—also furnish pull tests for each bar? Well, no; because the piece left after the bars were cut to the needed length, would be too short to make a standard 6″ test sample. A delay of five weeks loomed ahead. . . .

Then Ryerson metallurgists found a way: Inquiry revealed that the shafts were to be machined down at each end for a distance of 7″. So, why not cut a piece from the side of each bar, *before machining*—enough for all tests yet leaving sufficient stock for machining to size? The idea worked perfectly.

The data charts always furnished with Ryerson Certified Steels provided the exact analysis of each bar and assured proper heat-treatment. A few minutes hacksaw work yielded the necessary test samples . . . and all fourteen bars passed the rigid Navy Inspection with flying colors.

Ryerson ingenuity has helped many manufacturers in solving production problems—has also cut ultimate delivery time from months to days. Ryerson engineers and metallurgists, backed by a century of service to the nation, are ready to work with you in accordance with WPB plan in making the most of all available steel.

Cutting 6″ test pieces from side of bar without affecting length.

JOSEPH T. RYERSON & SON, INC., Chicago · Milwaukee · St. Louis
Cincinnati · Detroit · Cleveland · Buffalo · Boston · Philadelphia · Jersey City

RYERSON STEEL-SERVICE

GIVE A GOOD MAN *THE TOOLS HE NEEDS . . .*

ONLY MULT-AU-MATICS
HAVE ALL THESE FEATURES:

1. 8 Stations
2. Independent Speeds and Feeds at each Station
3. Horizontal Chucks
4. Minimum Floor Space
5. Automatic Operation
6. Easy Change Over
7. Continuous Flow Lubrication
8. Interlocking Safety Devices
9. Easy Tooling

THE BULLARD

● **The reason America is at last overhauling the Axis in war production is that our workmen *are* getting the tools. Tools that multiply man-hours . . . the only way we can hope to win the most desperate race that civilization has ever run.**

Scarcely a plane flies against our foes, for example, which does not carry vital parts machined by Bullard. By the Bullard Mult-Au-Matic, the marvel which will complete 30 or more machining operations at once, in the time required for the longest single one. By the V. T. L.—so versatile that they can turn from the tasks of peace to the works of war—or back—in a matter of minutes.

You know . . . and your skilled craftsmen know . . . that it's no simple matter to have *both:* the accuracy that today's close tolerances demand, and at the same time high output rates. It was Bullard's engineering foresight that made possible this combination, years before Pearl Harbor was dreamed of.

When once again we all can turn with eagerness to build the new post-war world, Bullard foresight and integrity will play the same vital part . . . will have ready the tools to make the most of your skill.

ONLY BULLARD V.T.L.s
HAVE ALL THESE FEATURES:

1. Vertical Design
2. Rigidity and Power for Carbide Tools
3. 5-Face Turret on Main Head
4. Centralized Control
5. Rapid Power Traverse of Main Head
6. 4-Tool Turret on Side Head
7. Simultaneous and Independent Head Action

COMPANY BRIDGEPORT CONNECTICUT

"TO GET THERE *Fustest* WITH THE *Mostest*..."

Official U. S. Navy Photograph

BULLARD

The old formula for victory still holds good today. But to achieve it is infinitely harder.

Our men today spend shells by the thousands of millions. They need bombers, fighters, tanks, ships, everything else in proportion. Yet each airplane engine, every tank tread sprocket, every ship's compressors must have the accuracy once deemed possible only for hand workmanship.

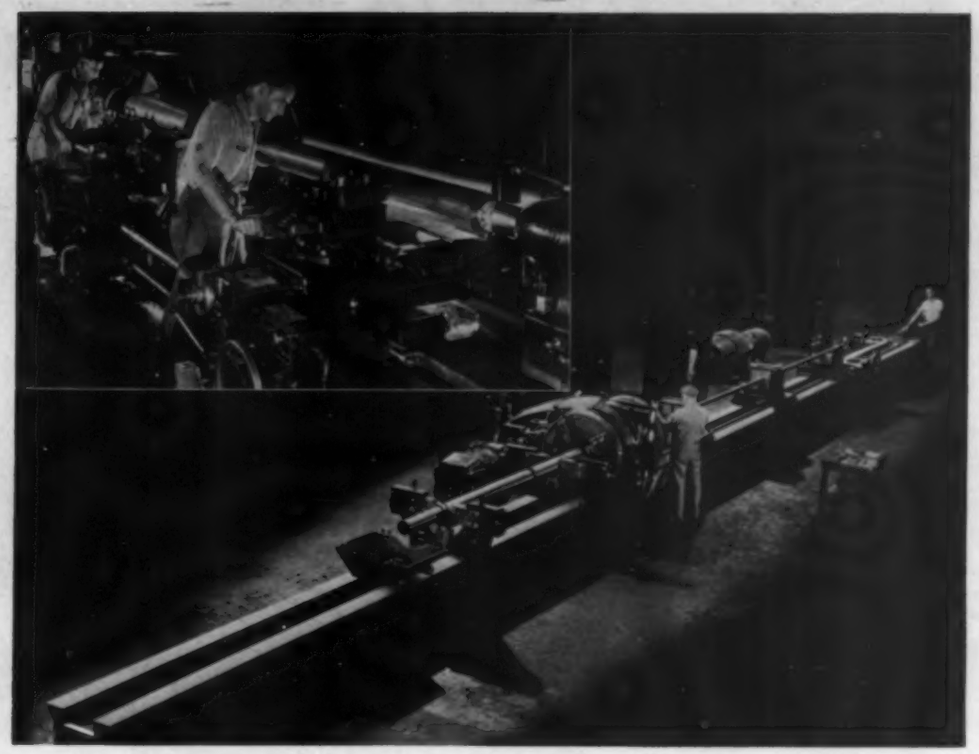
Hence, it is inevitable that America's war industry relies heavily upon the Bullard Mult-Au-Matic, the machine on which one worker can do the work of seven men . . . and turn it out within the closest of tolerances.

Bullard V.T.L.s, too, man the production lines which send out most of America's transport planes . . . and are veterans at building ships and locomotives.

Bullard engineers want to be sure that you are set up to get your "Mostest" from every job you do. Send them your data . . . they may enable you to cut your times still further.

THE BULLARD COMPANY

BRIDGEPORT, CONNECTICUT



Hollow-spindle gun boring lathe, with bed 64 feet long, is used to machine and rifle bore the 15½-foot barrel for a 90-millimeter gun in a Chevrolet plant. This is just one of the 354 separate machines required to finish the steel barrel. Turning tool slides are removed from the ways for the boring operations shown here

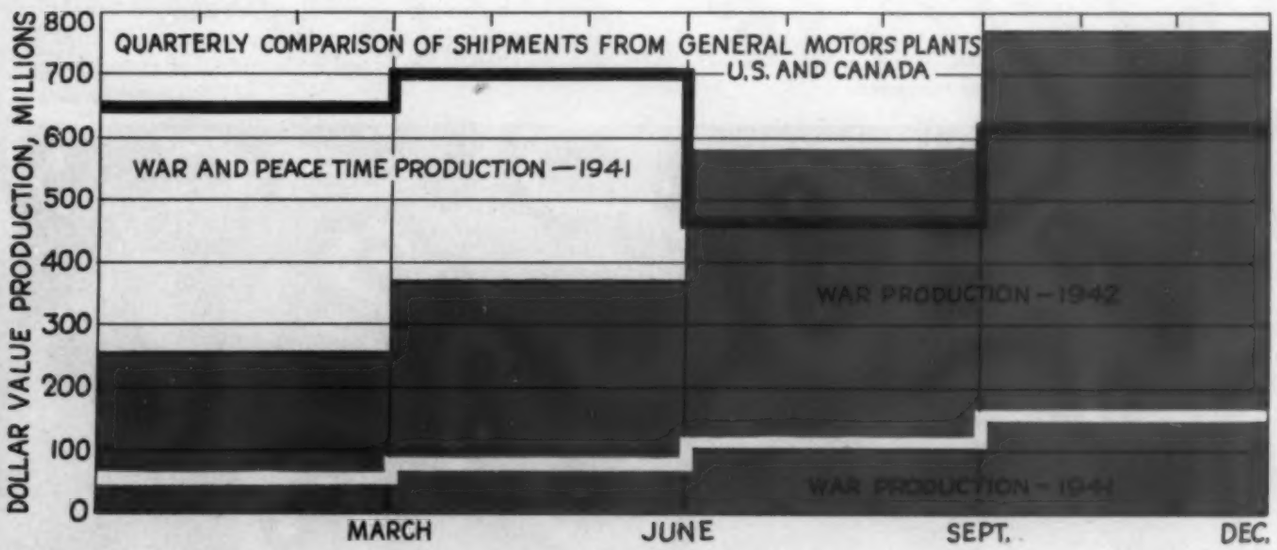
in the world. There are now better than 17,000 construction workers alone on the project and the corporation has 1200 of its own supervisory personnel in Chicago drawing up preliminary phases of the undertaking.

But the progress of the automotive industry in war production should not be measured against the record of a single unit. For the industry has dropped competitive lines of peacetime and banded together in a co-operative production movement which only the duress of war could have created. A year ago, industry leaders began to take stock of themselves. What did they have to offer? A reservoir of engineers, metallurgists, toolmakers, mechanics and craftsmen. A well-knit chain of supply companies. A vast array of plants and equipment. A background of experience in the planning and making and distribution of complex mechanical things. A managerial skill in co-ordinating materials and manpower and machines into a flow of goods for the fulfillment of human needs. All of these being basic elements to successful mass production.

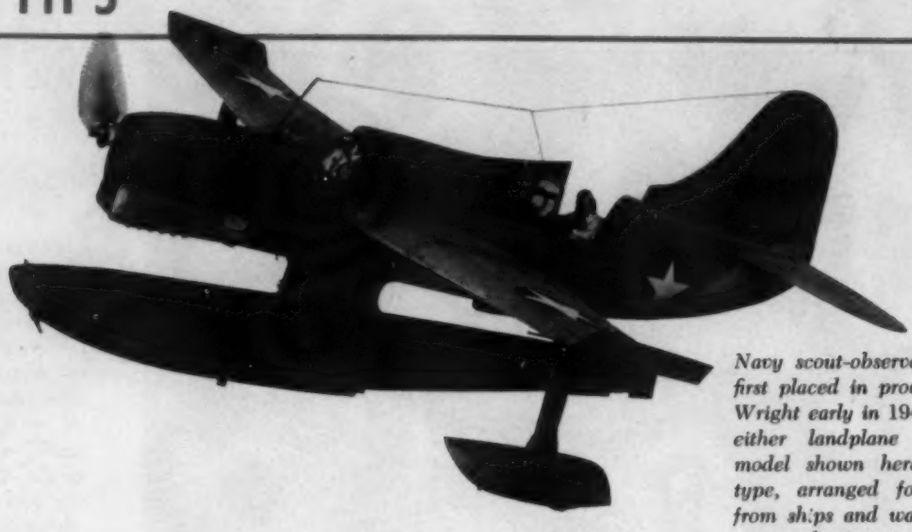
To these it was decided to add a new element—co-operation and interchange of information—obviously an impossible additive in the competition of peacetime but a most successful vitamin in time of war.

On the basic framework of the Automobile Manufacturers Association was erected the expanded structure of the Automotive Council for War Production, drawing in better than 400 more companies with a stake in the automotive industry. The tool and die shops, through the Automotive Tool and Die Association, were enrolled in the common cause. Scores of parts manufacturers,

(*Please turn to Page* 397)



WING TIPS



Navy scout-observation plane, SO3C, first placed in production by Curtiss-Wright early in 1942. Designed to be either landplane or seaplane, the model shown here is of the latter type, arranged for catapult takeoff from ships and water landings. Note upturned wing tips, a design innovation, and widely separated seats

Aviation catapulted into No. 1 rank in year. Dollar volume exceeds four billions. Tremendous expansion made possible by pooling of materials, processes and technical talents, within and without aircraft field

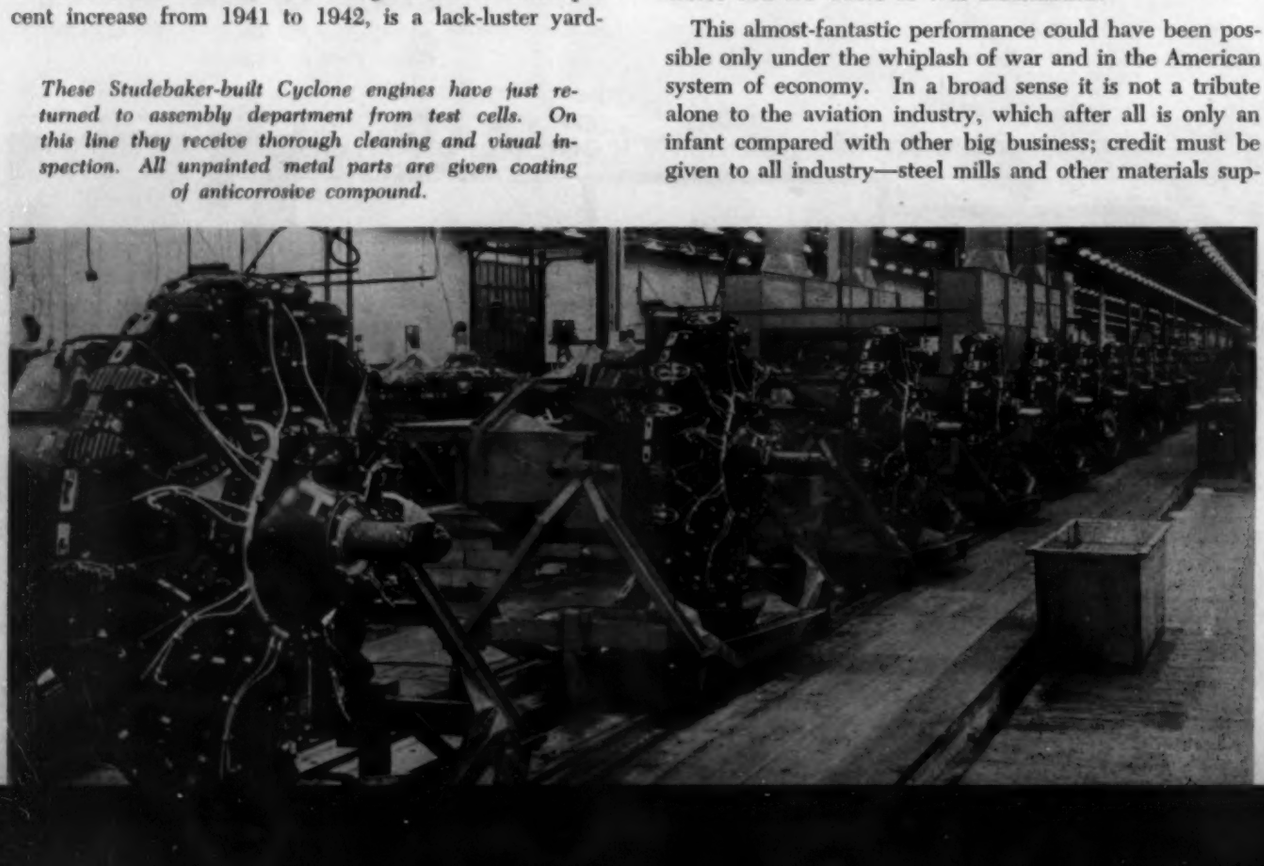
EASILY the most stupendous achievement on record in the annals of American industry is the catapulting of aviation into No. 1 rank in the short space of time since the Japs pounced on Pearl Harbor. It is all the more noteworthy when consideration is given the fact that, measured in dollar volume of output, aviation doubled itself in 1940, then tripled itself again in 1941. And last year the industry came only a short way from tripling its size again. Here are the figures showing dollar volume of output of airplanes, engines and propellers:

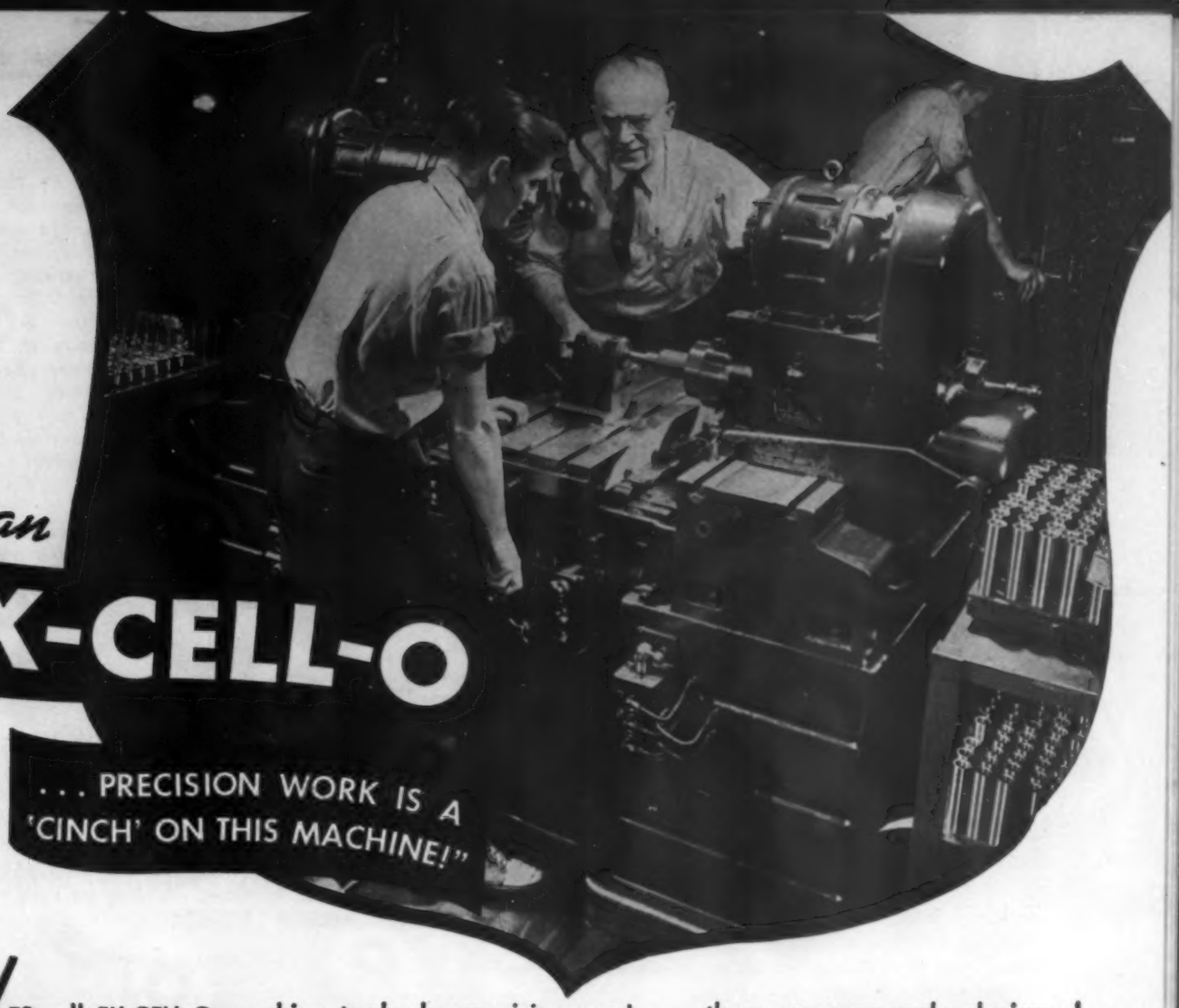
1939	$325,000,000	1941	1,650,000,000
1940	575,000,000	1942	4,250,000,000

But dollar volume, even though it shows a 160 per cent increase from 1941 to 1942, is a lack-luster yardstick to measure accomplishment. Consider some further enlightening statistics: Unit production of planes increased from 19,800 in 1941 to 49,000—up 147 per cent; tonnage of planes produced at the same time rose 300 per cent, reflecting the sweeping boosts in multi-engine ships; factory floor space increased 75 per cent and is now something over 80,000,000 square feet; number of plants building planes, engines or propellers rose from 59 to 100—up 70 per cent; number of employes increased 130 per cent, women alone 2575 per cent; man-hours worked increased 155 per cent; total engine horsepower produced was up 240 per cent from the 1941 level. These are all figures furnished by the Aeronautical Chamber of Commerce and the Office of War Information.

This almost-fantastic performance could have been possible only under the whiplash of war and in the American system of economy. In a broad sense it is not a tribute alone to the aviation industry, which after all is only an infant compared with other big business; credit must be given to all industry—steel mills and other materials sup-

These Studebaker-built Cyclone engines have just returned to assembly department from test cells. On this line they receive thorough cleaning and visual inspection. All unpainted metal parts are given coating of anticorrosive compound.





"It's an EX-CELL-O

. . . PRECISION WORK IS A 'CINCH' ON THIS MACHINE!"

YES, all *EX-CELL-O* machine tools do *precision* work . . . they are purposely designed and built that way. As a matter of fact, it's now common practice throughout the metal-working field to use *EX-CELL-O* as another word for precision. Take the machine tool illustrated here. It's one of nine standard styles of *EX-CELL-O precision* boring machines, thousands of which are doing 24-hour duty in practically every type of American war industry. They are performing a wide variety of machining operations—boring, turning, facing, grooving, chamfering—where tolerances are extremely close and the highest production is essential. Their flexibility in use, their compact construction, their smooth and easily-controlled operation, their great strength and extreme rigidity... all these standard features make every *EX-CELL-O Precision* Boring Machine a favorite with both operators and owners under today's strenuous production pace.

Over each of the four plants of Ex-Cell-O in Detroit fly three flags . . . the Stars and Stripes, as always, the Army-Navy "E" pennant, and the *first* U. S. Treasury "Bull's-Eye" War Bond flag.

NOTE—If you are using one or more of your Ex-Cell-O Precision Boring Machines for short runs, need quick change-overs, or an all-round standard fixture, check into the added flexibility and time-saving advantages that an Ex-Cell-O Universal Fixture will give you. Work, fixtures and tools can be quickly, easily and rigidly mounted in any desired position on the vertical slide of this fixture and the slide may be set at any desired angle for boring, turning, or facing.

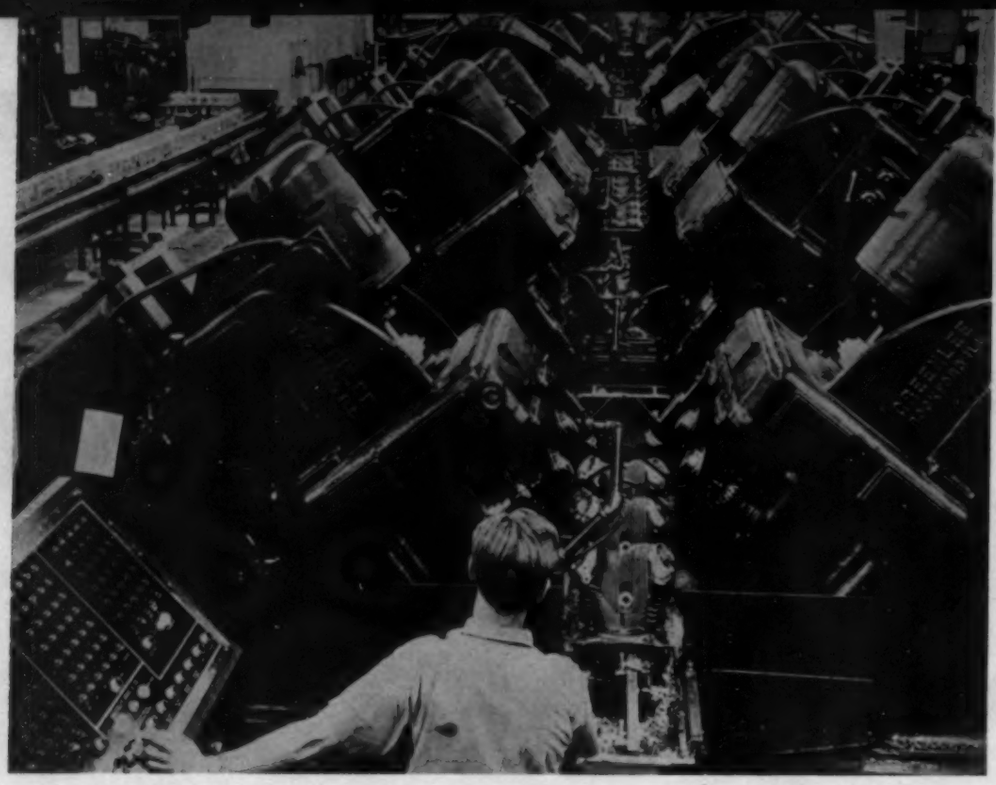
EX-CELL-O CORPORATION • DETROIT

To get best use of your Ex-Cell-O precision boring equipment, you should have the Ex-Cell-O Instruction Book. If you do not have it, write for free copy. State style of Ex-Cell-O machine you are using.

Precision THREAD GRINDING, BORING AND LAPPING MACHINES • TOOL GRINDERS • HYDRAULIC POWER UNITS • GRINDING SPINDLES • BROACHES • CONTINENTAL CUTTING TOOLS • DRILL JIG BUSHINGS • DIESEL FUEL INJECTION EQUIPMENT • R. R. PINS AND BUSHINGS • PRECISION PARTS

XLO

EX-CELL-O *means* PRECISION



Typical American ingenuity is responsible for this $800,000 conveyor-type, multi-station machine which cuts time for precise machining of cylinder heads from 300 man-hours to 47 seconds each at the Studebaker plant in South Bend, Ind., where Wright Cyclone engines are being made for B-24 bombers and Flying Fortresses. The machine has approximately 130 cylinder heads in process at one time, and has 162 tools, including 36 drills, 35 reamers, 15 mills, 30 taps and 46 special tools. NEA photo

pliers, equipment builders, materials handling experts, machine tool designers, the automotive industry and its vast reservoir of "know-how"—perhaps 20,000 companies working for the common aim of making the U. S. and its allies supreme in the battleair.

The production miracle of 1942 perhaps can be best explained in terms of "pooling"—of materials, of processes, of technical talents, of competitors within the industry, and of industries outside the aviation field. Thus the automobile industry has shouldered roughly 25 per cent of the total aircraft production load and probably by the end of next year will show an even higher percentage.

Aircraft companies themselves have joined hands in the so-called "bomber pools", Boeing, Douglas and Vega being one, and Boeing, Bell and North American (plus Fisher Body from the automotive industry) a more recent combination. Then there are the East Coast and West Coast Aircraft War Production Councils, organized during the past year to facilitate interchange of materials, technical information and policies among groups of airplane companies.

Associations Gave Assistance

To these co-operative efforts must be added the assistance provided by the 22-year old Aeronautical Chamber of Commerce, the research findings of the National Advisory Committee for Aeronautics, the centralized direction of the Aircraft Branch of the WPB (recently reorganized under leadership of C. E. Wilson, formerly General Electric executive), the co-ordinating activities of the Navy's Bureau of Aeronautics and the Army Air Forces Wright Field staff.

Never in all industrial history has there been the extensive and thorough process of integration and co-ordination effected such as is now in force in the field of aircraft production. The unraveling of this complicated pattern when the war has ended is a fearsome thing.

But the job has only started. While the President a year ago called for production of 45,000 combat planes and 15,000 trainers during 1942, those close to the industry knew this total would not be achieved since it represented nothing more than a figure to "shoot at" and a convenient propaganda device. The astounding thing is that production did come so close to this fanciful goal, even in spite of a deliberate slowing down in production of some models to permit retooling for mass production of newer types.

125,000 Goal for 1943

The goal for this year was set by the President at the same time at 100,000 combat planes and 25,000 trainers. This, too, may have been revised considerably in the meantime because of the decision to concentrate on more and larger 4-motor bombers, but the year ahead should certainly see output of 75,000 combat planes and 20,000 trainers, if hostilities continue uninterrupted.

To power this vast air fleet, as well as to provide spares and replacements for planes already in service, an outpouring of engine horsepower such as the world has never seen is in the making. Right now aircraft engine plants are turning out more horsepower in 15 days than was produced during the entire period of the first World War. A year ago, Col. John H. Jouett, president of the Aeronautical Chamber of Commerce (since resigned), said engine output was at a rate of 6,000,000 horsepower a month, and probably would reach 15,000,000 horsepower a month this year.

If anything, Col. Jouett's figures were on the conservative side, for the two principal radial engine builders, it was revealed (STEEL, July 20, p. 62), are planning to be producing at a rate of 50,000,000 horsepower a month by the end of this year, to which must be added the output of other radial engine builders as well as the production of liquid-cooled engine manufacturers. In all, it appears that 75,000,000 engine horsepower a month is likely, or an annual rate of 900,000,000 horsepower—far beyond anything even the automobile industry realized in its best year. Allison Division of GM is turning out engines at a rate of 50 per cent ahead of a year ago when output was announced to be 1000 engines a month. Early

ONE OF A SERIES OF SUGGESTIONS TO AID PRODUCTION

THE RIGHT OIL HERE SEALS THE PISTON... RESISTS RUSTING... RETARDS WEAR.
OIL MUST PERMIT THIS PISTON TO OPERATE QUICKLY, SMOOTHLY.

HOW TO SOLVE

Operating Problems with *Correct Lubrication*

Use Oil that Does 4 Jobs!

PROBLEM: Here is one of the simplest air tools made. It's a light hammer used to rivet airplane parts. But it's not so easy to lubricate as you'd think. That piston you see in the picture above shuttles back and forth 2,000 times a minute. And here—as in all compressed air tools—the metal parts are subject to the washing action of water condensed from the air.

ANSWER: You must have an oil that is (1) *light* —to permit fast action, quick valve action and (2) still *seal* the piston. It must also have (3) the *lubricity* to resist wear, and it must (4) *resist the washing effect* of moisture. Bigger air tools present more complicated problems. For light tools *Gargoyle Vactra Oil Light X* is used. For heavy tools such as rock drills, use *Gargoyle Almo Oil No. 3.*

GARGOYLE Lubricants

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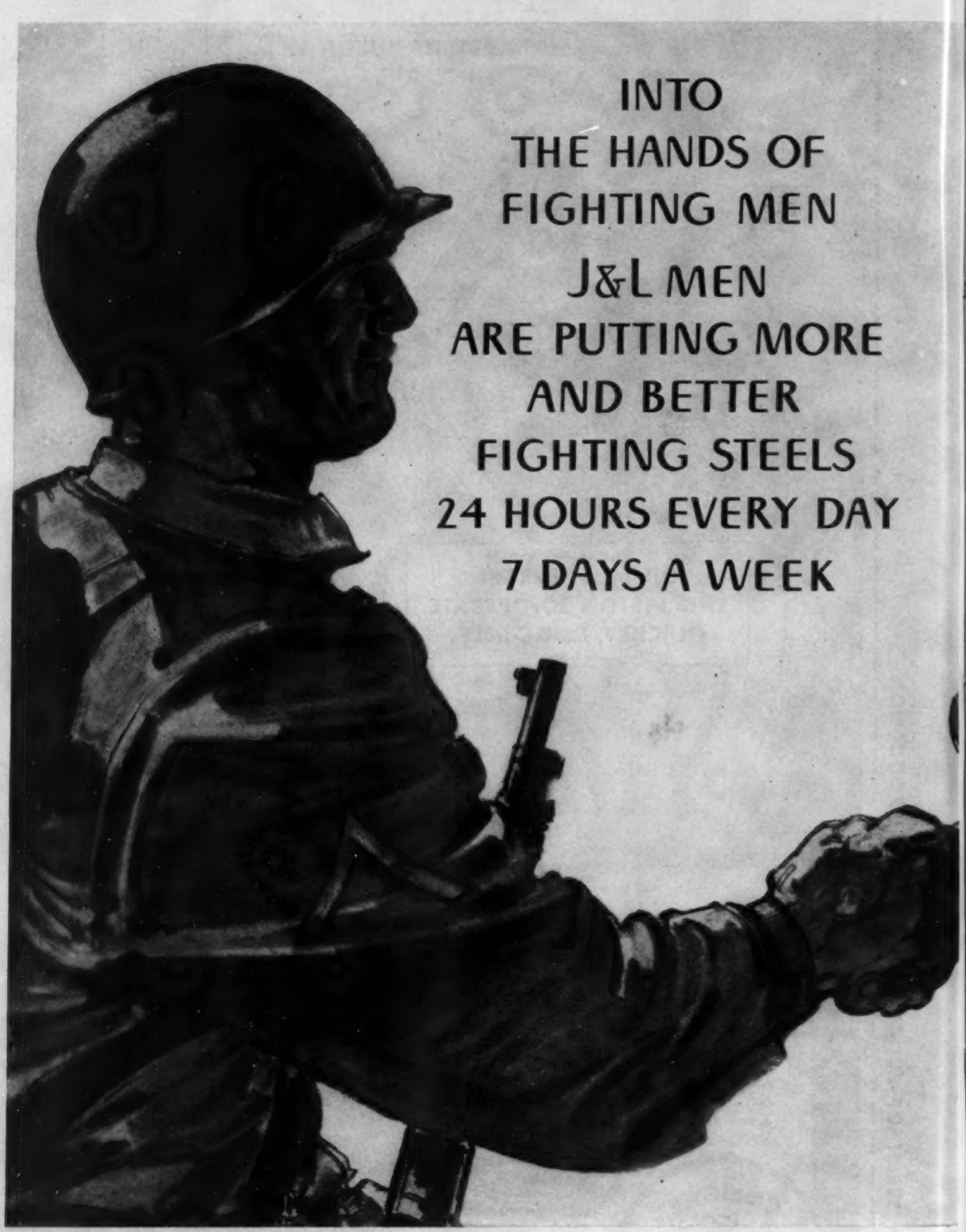
CALL IN SOCONY-VACUUM



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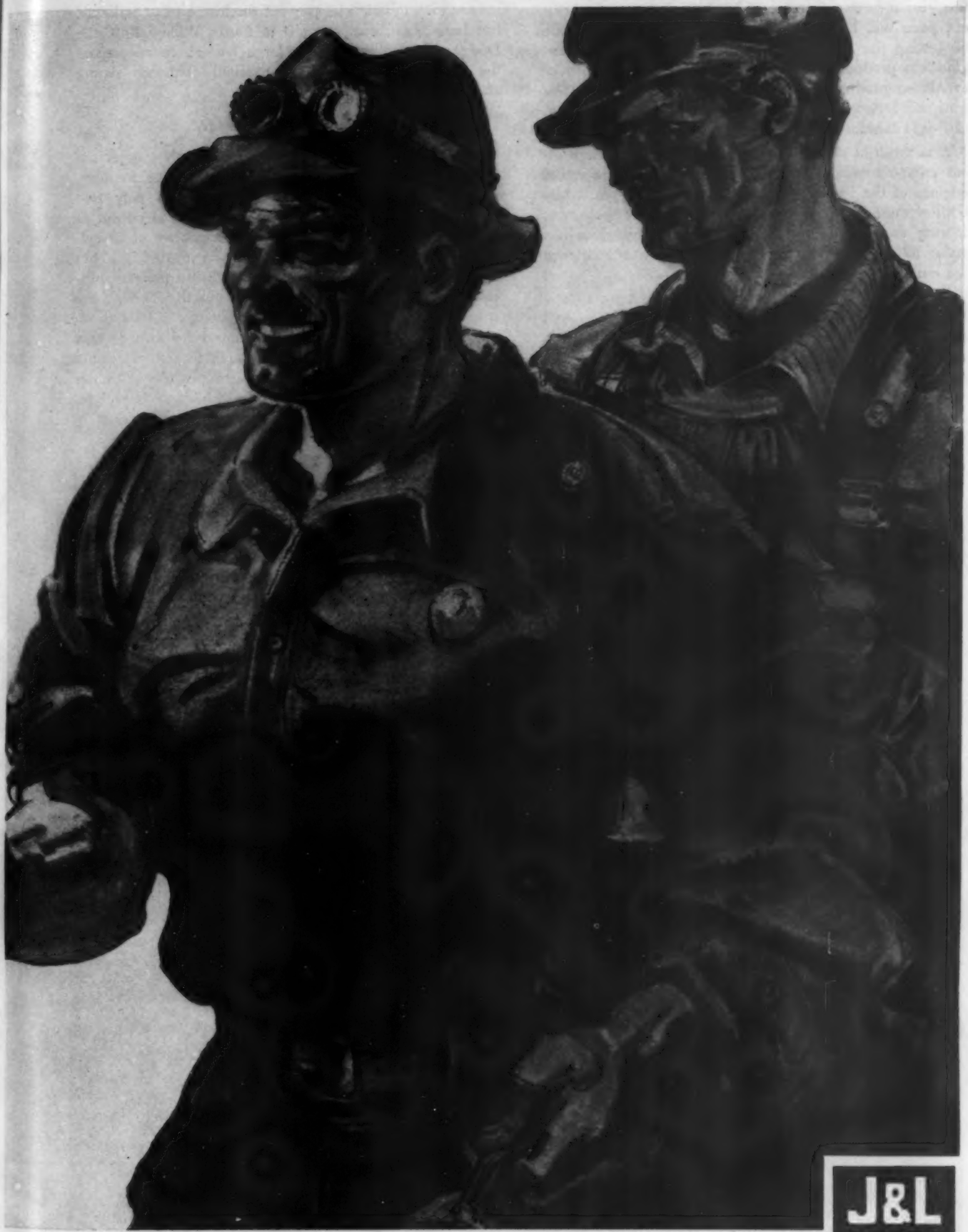


FROM AN ORIGINAL DRAWING BY ORISON MACPHERSON

J&L STEEL

PITTSBURGH, PENNSYLVANIA · CONTROLLED QUALITY STEEL FOR WAR

this year a further increase of 50 per cent from the present pace will have been effected, principally by virtue of getting the Allison 24-cylinder "double" or 3420 engine into production. Total floor space to be given over to Allison production, including that of Cadillac in Detroit and Delco-Remy in Anderson, Ind., will exceed that of Ford's limitless Willow Run bomber plant.

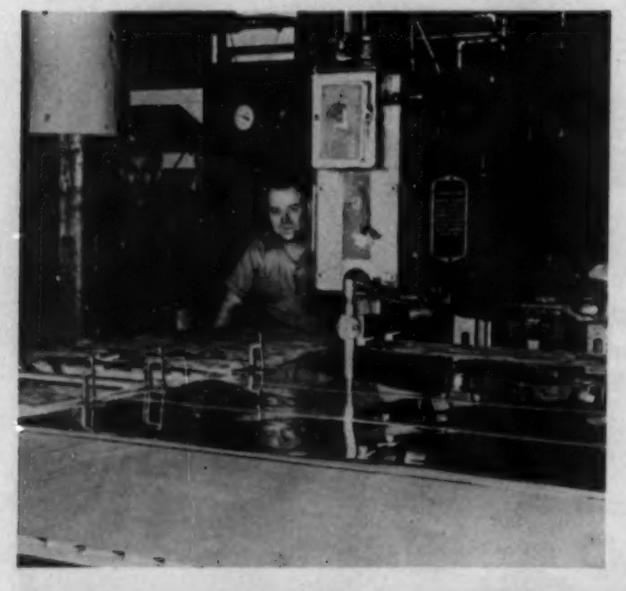
A network of six automotive plants and four independent engine builders is now functioning to supply radial engines of the Pratt & Whitney and Wright types, while both of these builders operate several plants of their own. During the past 27 months Pratt & Whitney alone has given its licensees in training and manpower assistance the equivalent of 41,666 man-days.

The Dodge Chicago plant of Chrysler Corp., shortly to be in production on a new type of Wright engine, will be one of the largest industrial units in the world, including two foundries, two forge shops, heat treating and die shop, test buildings, tool shop and other miscellaneous structures. Restrictions prevent disclosure of actual size, but here again, comparing it to Ford's Willow Run, the Dodge Chicago property is large enough to encompass the bomber plant "with 20 baseball diamonds strung around the outside".

Where Is the Ceiling?

Plans for airplane engine production simply stagger the imagination. Consider the fact that a single foundry, supplying cast aluminum cylinder heads to only two builders of a certain radial engine, is aiming at output of 8000 heads a day, or enough for 400 engines of 14-cylinder size, with 50 per cent spares provided. That's roughly 2500 engines a week, or 10,000 a month, sufficient for 2500 four-motor bombers a month. Now, there are at least four other foundries supplying a similar product and recently plans were announced for a large new plant to produce the Wright-designed forged aluminum alloy cylinder head, which is said to provide a 15 per cent increase in engine power with no increase in weight. Somewhere the arithmetic on cylinder head production

—o—



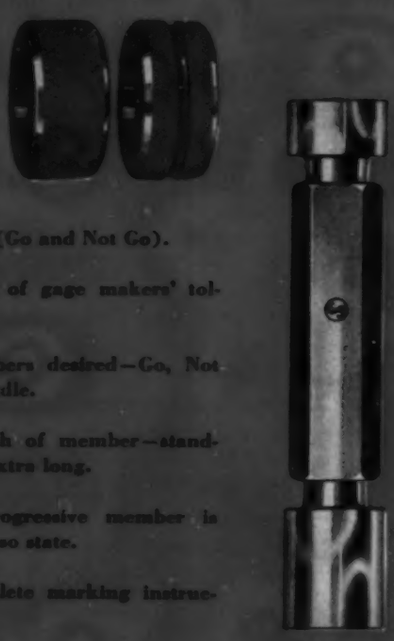
"Stitching" of outer skins for the Boeing Flying Fortress, B-17-F, by means of this spot welding equipment (left) was a process brought to perfection during the year. Developed originally by Stearman at Kansas City, the process is used now by other plants, including Murray Corp. of America, Detroit, where this view was taken. An automatic indexing table advances the lapped sheets ½-inch at a time, giving accurate spacing of welds and permitting a welding speed of 80-90 spots per minute. Refrigeration of the welding electrodes, a development of prime importance in welding aluminum alloy, results in better welds and greatly increases the number of spots which can be made between tip dressings

Every Packard-built Rolls-Royce aircraft engine (below) is "motored-in" under full oil and cooling pressure before going on dynamotor test. This powerful engine, battle tested in the famous Spitfire, flows in volume to United States and Allied fighting forces

How TO ORDER GAGES

When an order for fixed size gages fails to include complete gage specifications, the missing information must be gotten by further correspondence before the order can be put in production. This delays procurement of these vital tools and it also puts an extra burden on the time of procurement personnel. Both can be prevented by including all the following information on gage orders.

PLAIN PLUGS and RINGS



1 Size (Go and Not Go).

2 Class of gage makers' tolerance.

3 Members desired—Go, Not Go, Handle.

4 Length of member—standard or extra long.

5 If progressive member is wanted, so state.

6 Complete marking instructions.

SNAP GAGES

1 Frame size.

2 Frame model.

3 Range.

4 Stipulate whether gage is to be set and sealed.

5 Complete marking instructions.

THREAD GAGES

1 Size (Go and Not Go).

2 Threads per inch.

3 Class of fit for the work part.

4 Class of gage makers' tolerance and pitch diameter.

5 Members wanted—Go, Not Go, Handle.

6 Complete marking information.

7 Whether or not a setting plug is to accompany a ring gage.

8 If setting plug is ordered, whether ring gage is to be set and sealed.

It is always strongly recommended and good practice to order a setting plug for every thread ring gage purchased because there is no other good way of accurately checking ring gage wear or of resetting the ring gage to compensate for that wear.

The gage maker does not set and seal a thread ring gage unless he also furnishes a setting plug. He cannot do this because of the three variables involved, pitch diameter, lead, and thread angle. Every one of these is interrelated and every one may vary within its own tolerance zone. Thus, a thread plug and a thread ring made at different times or by different manufacturers may both be well within their tolerance limits in every element and still, because of these small cumulative differences, the two might not fit together precisely. When both the ring and the setting plug are made together, these differences can be adjusted, but not otherwise.

SHEFFIELD GAGES MASTER GAGEMAKERS

THE *SHEFFIELD*

CORPORATION

DAYTON, OHIO, U. S. A.

Last mortal view of many a Jap and German has been of a Flying Fortress, left

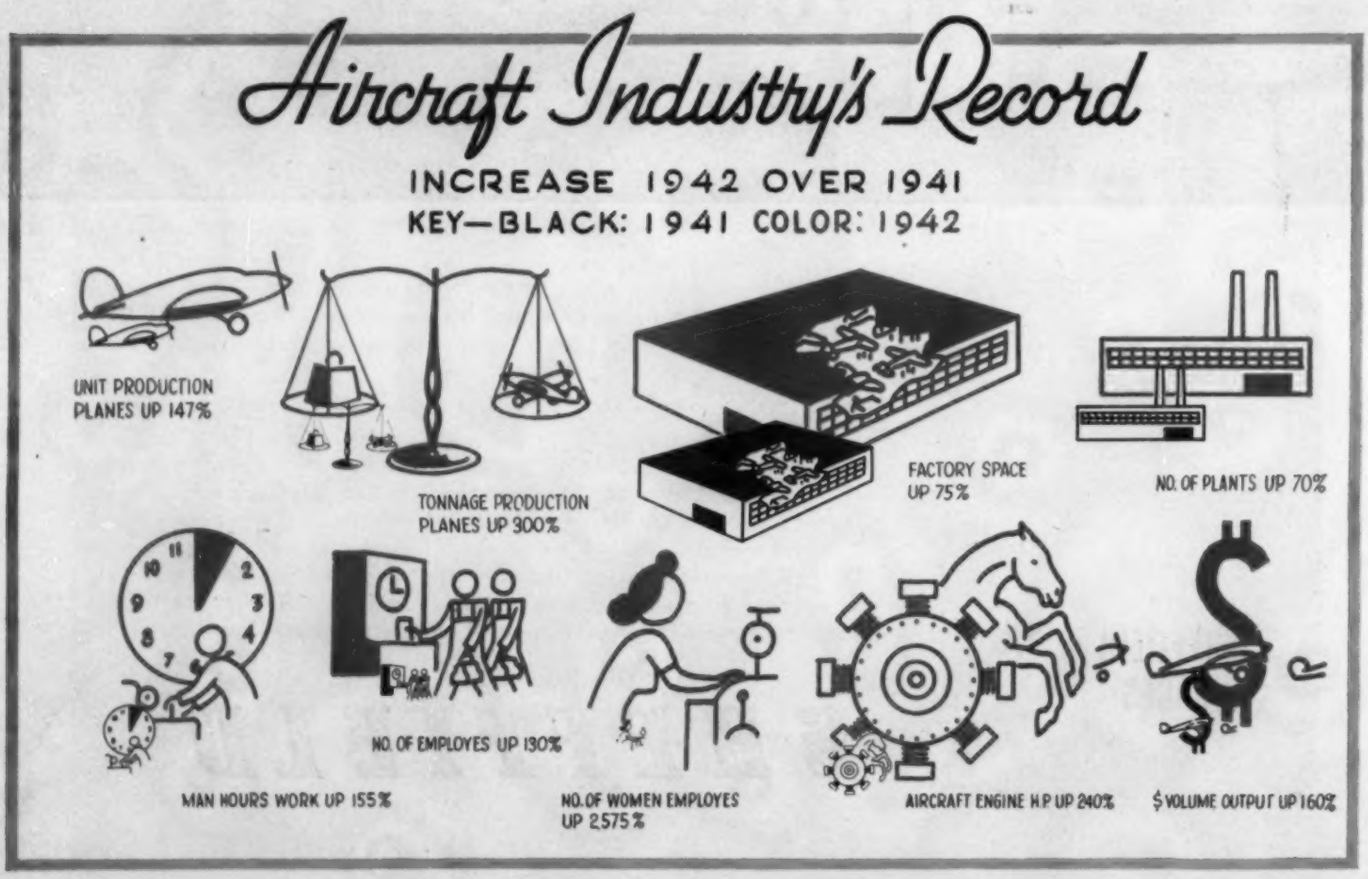
breaks down, or else the production planning is wacky!

Turn for a moment now to the requirements of a modern hard-hitting U. S. air force and see what is required in addition to the 2,500,000 officers and men which Lieut. Gen. H. H. Arnold has indicated will consttiute the Army air arm by the end of this year. There are conflicting opinions, even in the services, as to the best balance for a strong air force, but as to types the following powered craft are admittedly essential:

1. Dive bombers for attacks on enemy surface craft and for co-operation with ground troops.
2. Torpedo planes for attacks on enemy shipping and warcraft.
3. Carrier-based fighter planes for the Navy.
4. Medium and low-altitude land-based fighter planes, with heavy firepower, high speed and good maneuverability.
5. High-altitude fighter, pursuit and interceptor planes, with top speed and high rate of climb.
6. Two-motor attack bombers, or medium bombers, with high speed, long range and heavy bomb load.
7. Four-motor long range bombers, with heavy bomb loads, high altitude performance, maximum defensive firepower.
8. Transport ships, which may be adapted from commercial air liners or from bombers.
9. Light observation, reconnaissance and scout planes, which can get into the air quickly in limited takeoff space and with good hovering qualities.
10. Patrol bomber seaplanes, for coastal operations and offshore attacks on enemy shipping.
11. Single and twin-engine training planes for schooling pilots, gunners, bombardiers, observers, photographers, artillery liaison men, etc.

The U. S. army and navy air forces have all these types of planes, and obviously in increasing numbers. The principal problem, and the explanation of much of the criticism leveled against military air force leaders, is that of obtaining the proper balance between types. Even the Germans have not been able to perfect ideal balance

(*Please turn to Page* 399)


Aircraft Industry's Record
INCREASE 1942 OVER 1941
KEY—BLACK: 1941 COLOR: 1942
UNIT PRODUCTION PLANES UP 147%
TONNAGE PRODUCTION PLANES UP 300%
FACTORY SPACE UP 75%
NO. OF PLANTS UP 70%
NO. OF EMPLOYES UP 130%
MAN HOURS WORK UP 155%
NO. OF WOMEN EMPLOYES UP 2575%
AIRCRAFT ENGINE H.P UP 240%
$ VOLUME OUTPUT UP 160%

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● CLEAN—No fumes or dirt.

● QUIET—Soft exhaust is only noise.

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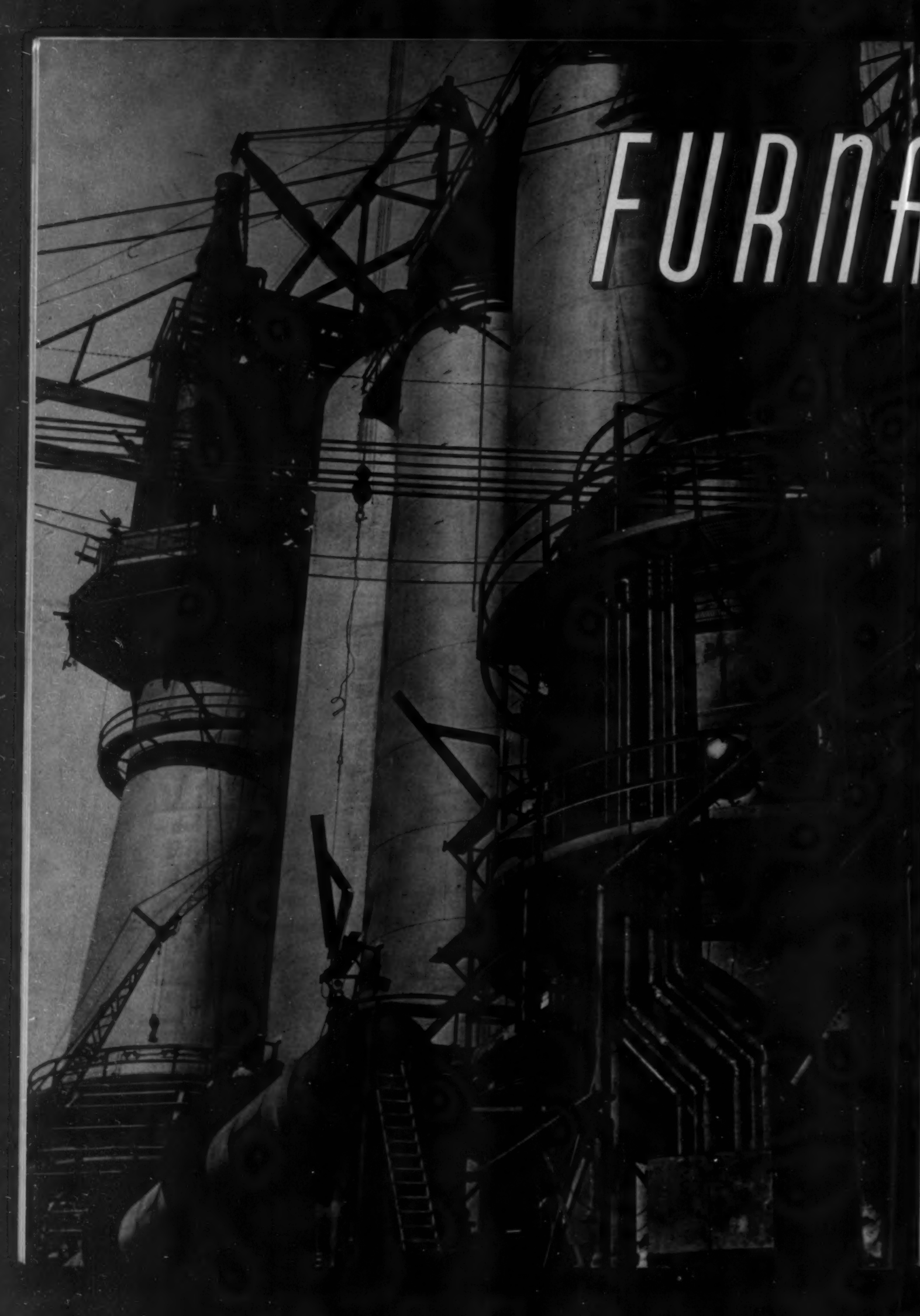

FURNA

...CEMEN...

Look to your Sinter

By JOHN D. KNOX
Steel Plant Editor

DEMAND for iron and more iron during the past 12 months strengthened the sinews of operators of blast furnaces in this country. Record after record, which stood for many years on blast furnace relining jobs, fell time and time again as brick masons swung their trowels with a vengeance. Custom was cast aside as ideas on operating practice at blast furnaces and "kinks" on their construction were interchanged freely from one end of the land to the other. What is the size of your stockline? What hot blast temperature are you carrying? What size tuyeres are you blowing? How much sinter do you have on your burden? These and many other questions were asked and answered by men making iron all over America—by men breaking record after record on some of the stacks long referred to as "the old pots". More hot metal passed beneath skimmers, up over the dams and down the runners in 1942 than ever before. More is to come. And this is the kind of information that makes the slanting eyes of a Jap open a little wider, or the mustache of a Hitler twitch a little longer, or the jaw of a Mussolini drop a little lower. Keep your eye on the little skip cars traveling up and down the skipways of American blast furnaces; they're making history as far as pig iron tonnage is concerned.

No startling developments in design made blast furnaces throw enormous tonnages of iron over stubby ladle spouts; nor were startling innovations incorporated in any particular stack to which the torch was applied during the year just closed. It all happened because blast furnacemen looked each other in the eye and swapped information that was straight from the shoulder. Nothing was held back; nothing concealed. "There is a job to be done, so let's do it" was the motive back of nearly all the broken tonnage records of the year just closed and back of the fact that new stacks started off with a 1200-ton daily run with little or no off-grade iron from the time the first drill was put to the iron notch and the initial bar started the first cast of iron flowing beneath the splasher plate.

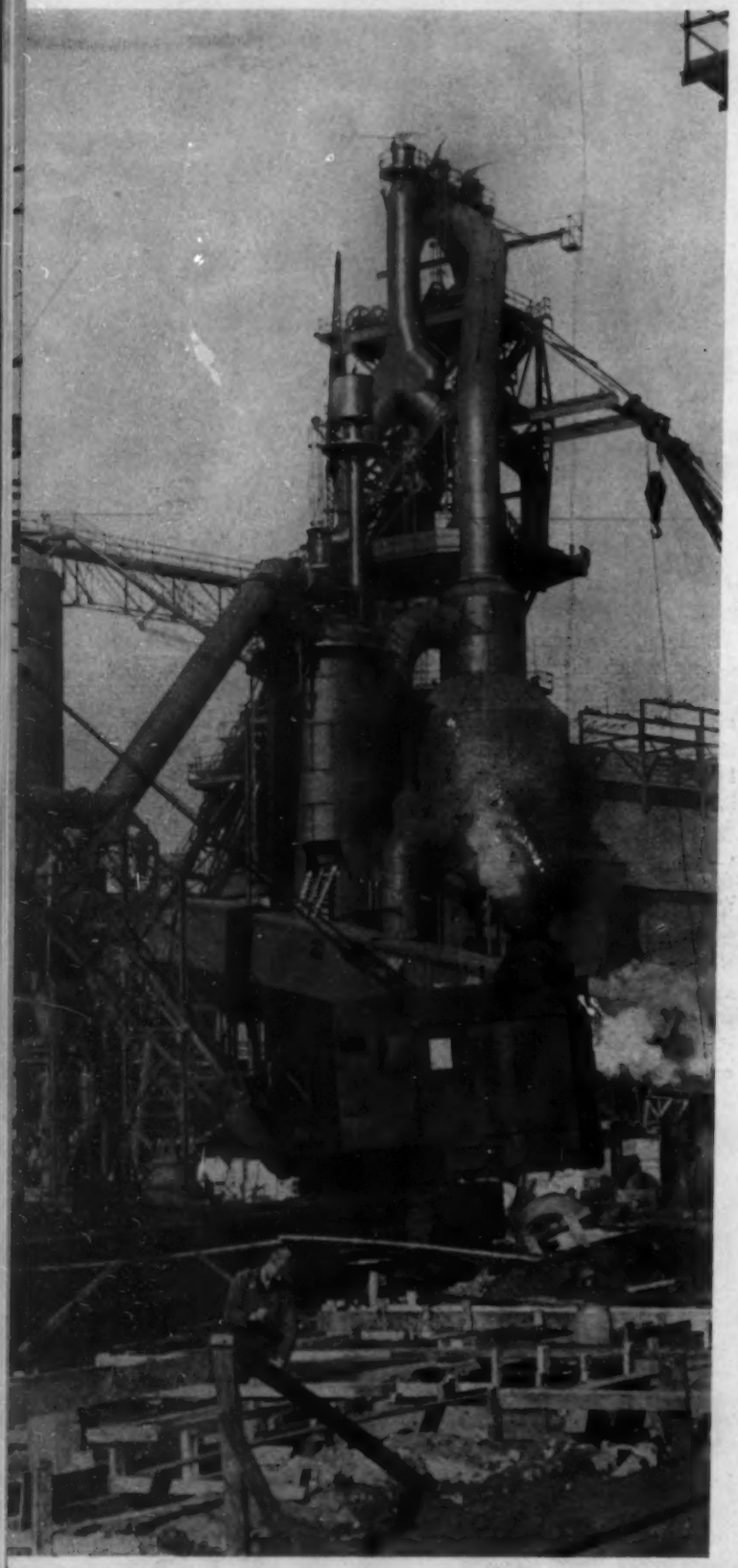
This new blast furnace, built by Republic Steel Corp. at Youngstown, O. for the Defense Plant Corp., has a daily capacity of 1100 tons of iron. All plate work on the furnace, hot blast stoves and gas handling equipment is welded

But there is more back of the story of large pig iron output which brightened the pages of record books for 1942. A trend became legible before the year was well advanced. It had to do with the use of sinter. A large steel company which had spent many thousands of dollars on experiments covering a 4-year period to determine the ideal percentage of sinter to use in its blast furnace burden, threw precedent to the winds. Top officials of this concern made their findings available to every pig iron producer in this country as a token of patriotism. Nothing was held back. All became public property. This move on the part of this company to add its bit to the war effort is enough to make every blast furnace operator hold his head high in the air, for that is the kind of stuff that is putting iron down over the runners in American cast houses today. What was done and is being done on stacks of this company by the use of sinter can be done by most, if not all, northern stacks. And its free for the asking. The results are astonishing.

Tests and actual practice disclose that by the use of 40 to 45 per cent of sinter in the burden the production of iron is increased from 10 to 19 per cent. That is enough to shake any blast furnaceman out of a state of complacency. Don your thinking cap and endeavor to recall anything as simple as this in the last two decades of blast furnace practice that has made possible such an increase in tonnage for entry on monthly report sheets. Instances are as rare as a well-stocked scrap yard outside of an open-hearth shop.

Increase in daily iron output bears an almost direct relationship with an increase in the percentage of a good quality sinter in the burden up to 45 per cent. Practice indicates that there is nothing to be gained by charging more than 45 per cent of sinter except the increased iron units in the sinter. This is attributed to the fact that the burden becomes so open that the intimate gas-solid contact is not maintained.

But there are further advantages to round out the picture. The pounds of coke required per ton of iron declines about 15 per cent and the flue dust consumption



New No. 6 blast furnace of the Inland Steel Co., Indiana Harbor, Ind. which began its first campaign Nov. 16. This stack, rated at 1200 tons per day, is the first to be built in the Chicago district since the outbreak of the war

per ton of iron about 22 per cent on furnaces burdened with 45 per cent sinter compared with those operated on lake ores. Then, too, substantially less flue dust finds its way into the dust catcher as the percentage of sinter and scrap in the burden is increased. With the burden including 45 per cent of these materials the amount of flue dust produced is only about 47 per cent of that blown into the dust catcher when the stack is working sinter-free Mesabi ores.

Reduced to specific terms it can be stated that a blast furnace with a daily rating of 1000 gross tons, with its coke consumption normal and its scrap consumption practically constant, can produce about 140 more tons of iron per 24 hours when its burden includes 45 per cent sinter.

That is to say: Start loading skip cars serving 10 individual blast furnaces in this country with sinter in the ratio as mentioned and extra ladles holding the equivalent iron output of a brand new modern blast furnace will be on their way to the mixer building at the steel plant. And if this is not enough to persuade blast furnace operators to cast a searching eye at their sintering plants then pig iron is not as important as some operators believe.

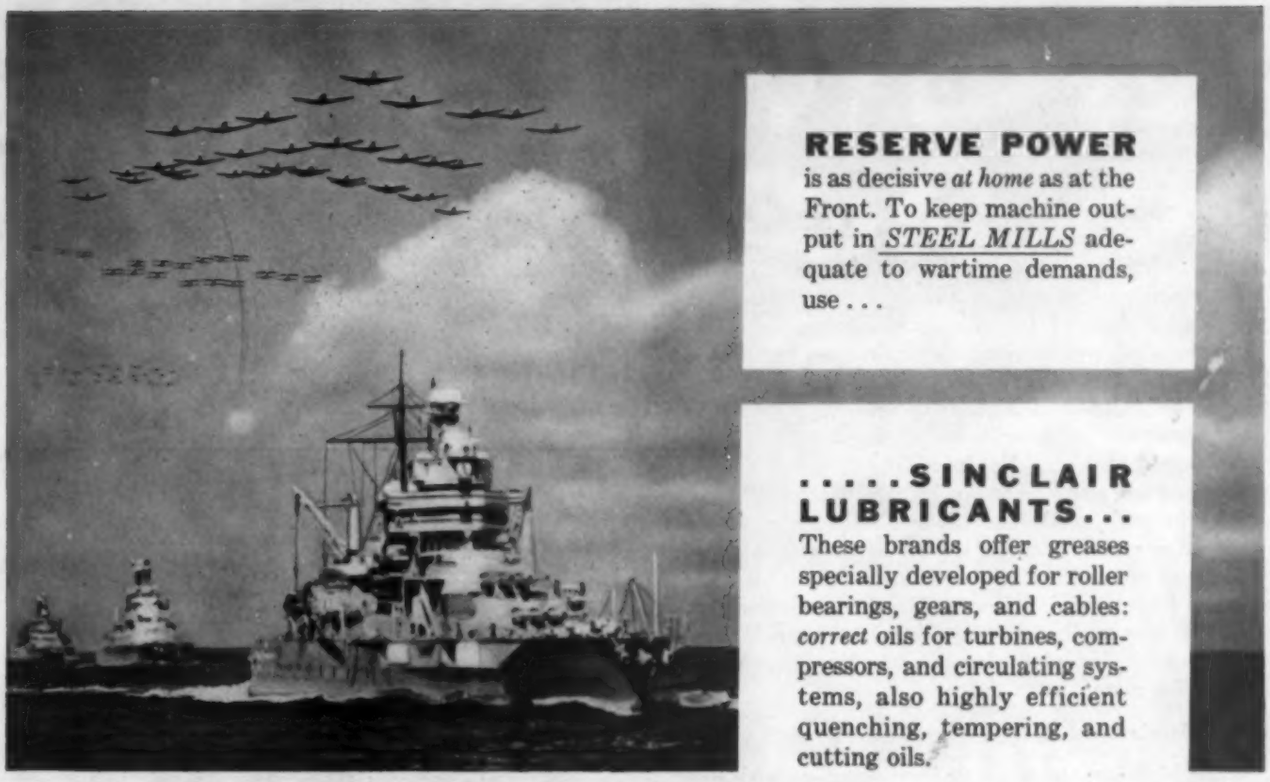
Involves Additional Capacity

Sintering machines operating at various plants in this country are in a position to produce sinter at a rate estimated between 12,000,000 and 13,000,000 tons annually. However, only a portion of this output of sinter can be considered of sufficient high quality to assure satisfactory smelting operations. So that any program involving an increase in the sinter charge from present practice up to the 45 per cent ratio would necessitate the installation of additional sintering capacity.

Such a program is regarded highly favorable because of the small amount of time involved in construction compared with that required to complete new blast furnaces. The cost also is a factor. A sintering plant capable of producing 1000 tons or more per day can be built for about 10 per cent of the cost of a modern blast furnace. It is the difference between $5,000,000 and $500,000, not considering the cost of building new by-product coke ovens to satisfy the fuel requirements of the new stack. Certainly it is worth playing around with. Have you tried it, Mr. Blast Furnaceman?

Another interesting angle to this question of sinter supply concerns the nodulizing of flue dust in rotary kilns. There is nothing new concerning the adaptation of the rotary kiln for the production of nodules; kilns have been used for this purpose for many years. But ironmasters with forethought have taken advantage of a situation that has been a means of augmenting the sinter supply above their own producing facilities. The situation is this: a few cement manufacturers faced with slack operations in their own business have made their kiln capacity available to certain ironmakers. Material from blast furnace dust catchers shipped to these cement kilns as fines is being returned to the blast furnace tailor-made into nodules—idleness averted on the one hand; war effort stimulated on the other.

At three blast furnace plants in widely scattered locations practically all flue dust accumulations are being put through kilns for conversion into nodules. Moreover, another ironmaker is giving serious thought to this means of converting flue dust into chargeable form and may lay



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down a nodulizing plant to handle his flue dust accumulations.

And here is a singular thing observed by a blast furnaceman. Sinter made with limestone screenings has a glassy edge and is difficult to reduce in the furnace but when powdered limestone is employed as a component the edges have a dull finish and the sinter is more easily reduced. Hundreds of tons of this dull finished sinter is being shipped to a group of stacks in Pennsylvania and when a sufficient supply is on hand the charging board in the stockhouse showing the weight of materials per round being dumped into the receiving hopper at the top of the stack will be altered to include 40 per cent of this sinter.

Little insignificant changes have made it possible for blast furnacemen to crowd more sinter on their burdens over a period of years. Not long ago the aim of the sintering plant foreman was to run his machines so that they would discharge good-sized clinkers and thus meet the specification greatly desired by the superintendent over in the front office. Since then, the fancy of the blast furnaceman has changed. He now likes his sinter finer and firm—the finer the better. Give him sinter like BB shot and he'll put it through his furnace, pass the cigars around and ask for more.

Steelmakers Make Various Improvements

While blast furnacemen have been wrestling with their problems steelmakers at various open-hearth shops throughout the land have been taking advantage of every known means to get more steel into the ladle. Larger charging boxes were placed in service for one thing which permitted the cranemen to load more stock with less leveling and truing of the boxes. Track layouts in many a shop were altered to permit little dinky engines to chug their drags of scrap up over the highline quickly and spot them in front of freshly tapped furnaces waiting for a chance to melt down another charge.

Then, too, when the time came for a rebuilding job, the blueprints called for larger door openings. Last year many a 6-door furnace had its face lifted to a 4-door furnace in order to take larger charging boxes and thus expedite the charging time. At some plants the stockhouse boss has his orders to load up 40 per cent of the total charge in the first drag in order to assist the charging machine operator to adhere to a maximum charging time of two and one-half hours. For it has been found that when the charging time exceeds three hours there is a reduction in the output of about 10 per cent.

Some open-hearth operators advocate the bundling of turnings though there is some question whether this can be done. One steel producer tried to mix turnings with tin plate scrap but the components just would not stick together.

While the steel industry is confronted with many problems at the moment perhaps one of the most trying is that of man power. How to induce men to come into the open-hearth shop and learn the art of steelmaking is a headache that aspirin will not cure. There is no substitute for experience when it comes to putting on a pair of blue glasses and following a heat from the meltdown to the finishing-off period.

First helpers on an open-hearth furnace are not made in a year. Neither can the art of first helping be learned back in the class room. Steel still is made on the end of a shovel, using mill parlance, and this is just as true today as it ever was. Whenever you see a lad going through the turnstile at the clockhouse and out into the mill yard with a well-filled dinner pail swinging at his side and later taking his place in the midst of a seasoned bunch of sweaty men who heave and cuss and swing a sledge and clutch the bar with their calloused hands, push it through the wicket in one of the charging doors and knock out a heat—whenever you see a lad doing this then you know there is another steelworker in the making, a first helper perchance.

And so ways and means of getting recruits to take up open-hearth steelmaking as their life's work are being studied and cuddled by many executives. One company has been rather successful by advancing the men in its own shop rather than by drawing operators from the outside. Many are agreed that training classes should be in session if the steel industry is to build for the future.

Another problem that is plaguing steelmakers is absenteeism. After a pay day it is tough going in many open-hearth shops and what is more, no remedy for this situation yet has been found.

Then, too, if you squint out of the corner of your eye at the materials on the charging floor, you'll notice that charge and feed ore is not piled as high as it once was. Cargoes from foreign countries like Brazil and Sweden are not coming to our shores as they did when the going on the oceans was smooth. Moreover, the supply coming from our own mines is not sufficient to satisfy demand. In fact, some believe there will be a shortage next year of better than 3,500,000 tons.

An Ohio steelmaker has resorted to the briquetting of its soft ore for charge and feed purposes. The process is simple. Equipment merely includes a concrete mixer and a jolt machine. Soft ore and from 1 to 1¾ per cent of cement are mixed in the concrete mixer with the proper amount of moisture and then fed into a steel form resting on the platen of a jolt machine. After jolting, the form is removed and the briquette weighing about 90 pounds and resting on a steel plate, is conveyed away from the machine and piled for drying. Three days usually are required for drying; during the winter months stoves are installed in the building and the heated air circulated. The cost of briquetting is about $1.00 per ton.

In practice, a 5-inch layer of lump ore screenings is scattered over the limestone on the hearth after which the furnace is operated for about 25 minutes to eliminate as much moisture as possible. Then the briquettes, which average 11 per cent moisture and 8 per cent silica, are charged and the furnace again operated for about 20 minutes to drive off the moisture. A few blowups occur when hot metal is added but these are fewer in number and less violent than when plain ore is used.

One of the latest developments is a machine being manufactured by a Cleveland concern which briquettes fine ore for charge and feed purposes into 4-inch cubes weighing between 6 and 7 pounds. The cubes, following compression, are dried at a temperature of about 130 degrees Fahr. for a few hours so that they will withstand ordinary handling common to feed and charge ores at open hearths. A complete description of this machine as well as details of the mix and commercial tests will be presented in next week's issue of STEEL.

A Real Aid to PRODUCTION

TYPE CDE-X
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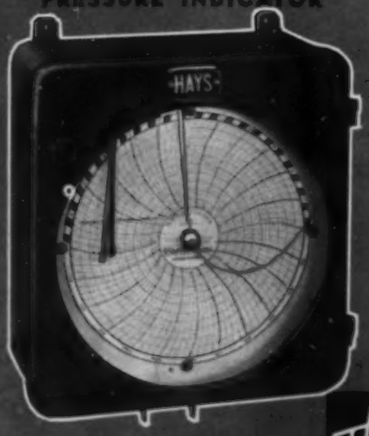
SERIES FOT
PRESSURE INDICATOR



SERIES OT
PRESSURE RECORDER

HAYS
OPEN HEARTH PRESSURE CONTROL

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"Gentlemen, you wire product manufacturers and wire processors sure helped make me what I am today. For many years you've posed highly technical problems of wire fabrication and use — in hundreds of peace-time products. But I'm grateful for them. Every one of those problems helped toughen my muscles for today's one big job—winning the war.

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SPECIAL ANALYSIS WIRE FOR ALL INDUSTRIAL USES

SAMSON SPRING WIRE

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54 Years of Wire Making Experience

RAW MATERIALS

New records set in all supplies for steel industry. . . Only scrap fails to meet needs. . . Iron ore movement tops War Production Board requirements. . . Coke output expanded

AMPLE supply of raw materials to support the greatly accelerated production of iron and steel in 1942 was furnished in all lines but steelmaking scrap and new records were made in all. The new peaks reached in 1941 as defense and war needs stepped up steel production were far exceeded last year, setting figures far above any prior accomplishments.

Lake Superior iron ore provided the most spectacular feature, shipment of 92,076,781 gross tons during the navigation season exceeding the 1941 record of 80,116,360 tons by 11,960,421 tons, a gain of 14.93 per cent. A new record for monthly shipments was established every month except November and December, when bad weather interfered.

Stocks on hand at lower lakes furnaces and docks Dec. 1 were estimated at 53,500,000 tons, highest ever attained, comparing with 45,534,633 tons Dec. 1, 1941. It is assumed this will be ample to carry steel production over until the 1943 navigation season, even at the high rate of consumption prevailing, which has been about 7,000,000 tons per month.

Iron ore consumption in 1942 was about 82,750,000 gross tons, estimated on figures for ten months, another high record, compared with 74,570,000 tons in 1941, an increase of more than 10 per cent. The record of 63,645,000 tons smelted in 1929 has been so far surpassed in 1941 and 1942 that it ceases to be a point of comparison.

Opening of the shipping season about March 20 was earliest in history by about 12 days and the first ore cargo arrived at Cleveland March 28. During March 792,558 tons were carried down the lakes, the first ore ever unloaded at lower lakes ports in that month. As of

Lake iron ore vessels operated late in the season, defying snow and ice, until forced to stop by dangerous weather conditions. Cannon from previous wars became part of the scrap charged into open hearths

May 15 the fleet was engaged 98.32 per cent in the ore trade, rising to 99.66 per cent by June 15 and from July 15 to the end of the season it was at 100 per cent. Carriers numbered 298 at the start and increased to 303 at the close. In addition to the American fleet 35 Canadian vessels were engaged in transporting ore to American ports under special permission by Congress. Trip capacity rose from 2,724,540 gross tons as of May 15 to 2,778,140 tons as of Sept. 15, based on 20-foot draft. The latter figure compares with 2,688,040 tons Sept. 15, 1941. The 303 bottoms in the ore trade at mid-September compared with 292 a year earlier.

Set 100,000,000 Tons for 1943

War Production Board set a goal of 91,500,000 tons for the 1942 season and this was passed late in November, assuring full compliance with the high quota deemed necessary to meet war requirements. Loadings to Dec. 7 passed 92,000,000 tons, with several more cargoes to follow. Freezing of ore in cars and pockets slowed loading and by Dec. 10 the season was over, December shipments of 635,829 tons being 199,252 tons less than in December, 1941, a decline of 23.86 per cent.

Office of Price Administration allowed a vessel rate on ore 25 cents per ton above the regular charge, to cover added expense for transportation under winter conditions. This increased the rate from 80 cents to $1.05 per ton.

In 1943 it is expected 100,000,000 tons of ore will be carried. Plans are being made for an early start, with ice-breaking equipment provided to clear the way in harbors and about the Soo and 16 large new carriers now being built will join the 1942 fleet, greatly increasing carrying capacity.

Not all upper lakes ports made new records in 1942, Marquette, Mich., and Ashland, Wis., falling behind. The former sent a large tonnage by rail to Escanaba, Mich. Ore from the Gogebic range, which loads at Ashland, was produced at capacity but fell short of the 1941 total because the latter was contributed to largely from stockpiles carried over from 1940.

Canadian shipments were at an all-time high, 472,871 tons, compared with 461,575 tons in 1941. This ore was sintered material from the New Helen mine. In 1915 this mine shipped 369,000 tons of unsintered ore.

Ore, Scrap, Coke, Limestone Statistics

(Unit: 1000 tons)

	Lake Superior Ore Consumed	Shipped by vessel	Domestic scrap consumption	Total coke production	Lake shipments limestone
1942	*82.785	92.076	*55.632	*69 991	*18.500
1941	74 570	80.116	54.446	64.765	17.633
1940	62.500	63.713	41.687	57.072	15 500
1939	44.361	45.072	32.434	44,425	12 208
1938	25.703	19.263	21.528	32.496	8.240
1937	53.996	62.598	38.006	52.375	14.429
1936	44 639	44.822	36.358	46.275	12.080
1935	30.789	28.362	26.415	35.141	9.082
1934	22.113	22.249	18.800	31.821	7.392
1933	18.115	21.623	17.400	27.589	6 664
1932	10.288	3.567	10.000	21.788	3 928
1931	24.114	23.467	18.300	33.728	7.208
1930	45.192	46.582	26.600	48 302	12.432
1929	63,645	65,196	37,600	59,883	16,269

Iron ore and scrap, gross tons; coke and limestone, net tons. *Estimated.

The only raw material not adequate to demand was steel and iron scrap, which was below requirements the greater part of the year and steel production was reduced to some extent for this reason. The shortage had started late in 1941 and continued through the first three quarters of 1942. Various salvage efforts were inaugurated during third quarter which brought out a large tonnage from various sources and solved the difficulty for the remainder of the year, though the threat continued of a shortage during first quarter this year.

By the middle of December signs appeared of shortage, due to winter weather slowing production and lack of manpower and truck capacity to gather scrap.

Despite this lack of material estimated scrap consumption in 1942 was greater than in 1941, with 55,632,000 gross tons, compared with 54,446,000 tons in 1941. A survey by the American Iron and Steel Institute revealed that scrap reserves in the hands of steel mills increased by about 1,400,000 tons between April 1 and Nov. 1 but was about 700,000 tons short of normal at the latter date. Total scrap in stockpiles Oct. 31 was estimated at 3,254,000 tons, compared with 1,794,000 tons April 1. A normal reserve is estimated at about 4,000,000 tons.

Melters Use More Pig Iron

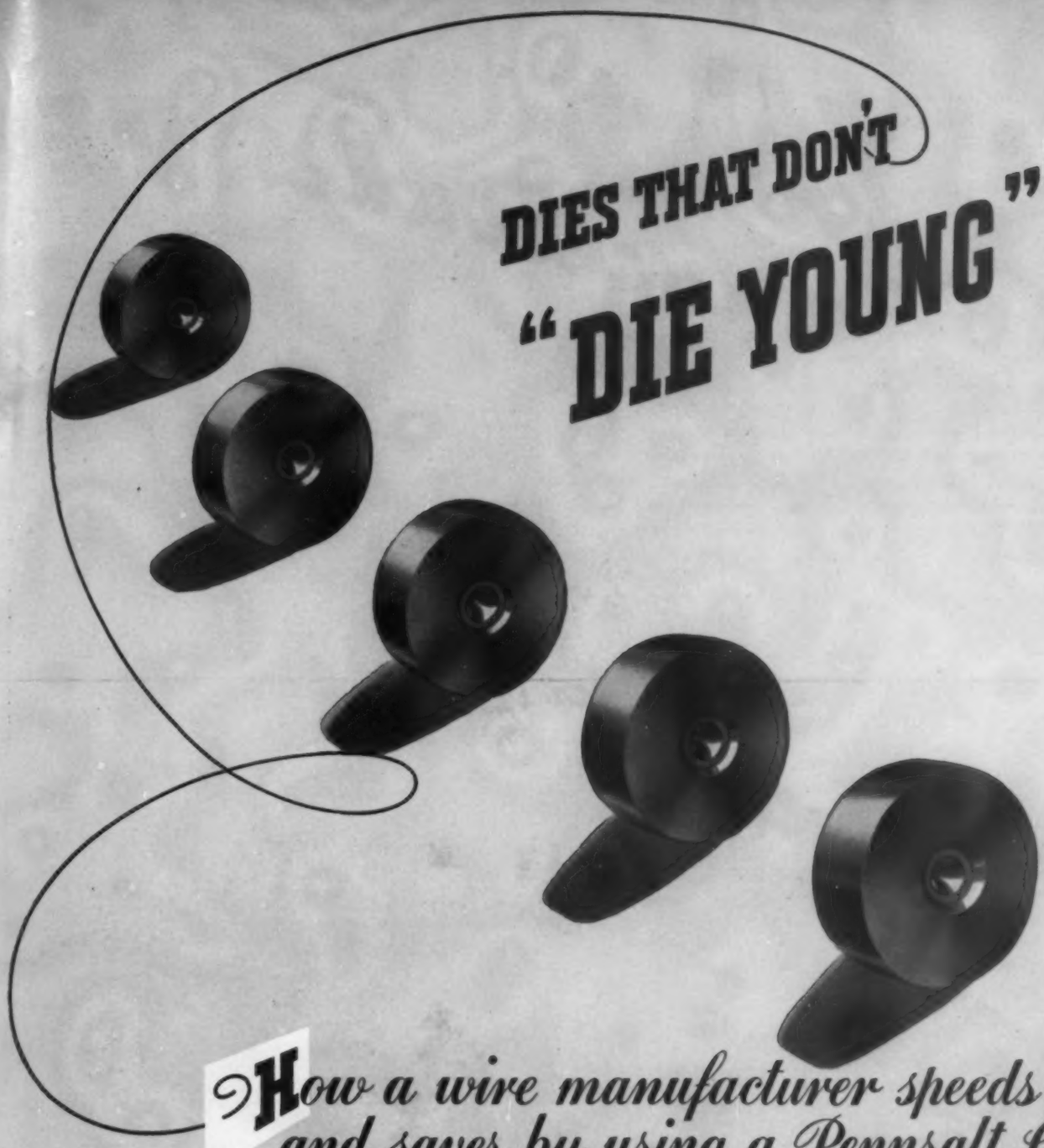
One effect of the scrap shortage was to cause steelmakers to use a greater proportion of pig iron in steel furnaces. In 1941 an average of 557 tons of pig iron and 523 tons of scrap was charged per 1000 tons of steel. In 1942 the pig iron charge increased to 593 tons and scrap declined to 496 tons. Slightly more iron ore was also used in the open-hearth charge. By these means output of steel was kept at a high point in spite of lack of scrap.

Steady production of coke marked the entire year. Estimated production based on ten months' output was close to 70,000,000 tons, of which about 62,000,000 tons was by-product and 8,000,000 tons beehive. To insure continuous beehive production by high-cost ovens Office of Price Administration in August authorized an increase in price from $6 to $6.50, Connellsville. This applied to certain hand-drawn ovens for which coal was trucked from mines. Numerous producers had petitioned for such action and presented evidence of increased cost of coal and transportation which had absorbed profits.

Estimate of bituminous coal consumption in 1942 by Harold L. Ickes, secretary of the interior, indicated an all-time record, exceeding the prior high of 579,000,000 tons in 1918. His estimate of bituminous needs for 1943 was 600,000,000 tons, based on increasing requirements for railroads, utilities, iron and steel plants, domestic heating and miscellaneous industries. Anthracite production now is about 60,000,000 tons annually but it is estimated 1943 requirements will result in an increase over that figure.

Limestone shipments by lake in 1942 are estimated somewhat in excess of the 17,633,448 net tons transported in 1941. Uncertainty results from the fact that ships ordinarily carrying this material were diverted for part of the season to carrying iron ore and the limestone was shipped by rail. It is a certainty that more stone was used than in 1941, to produce the increased steel tonnage but shipment was both by water and rail and the situation therefore is confused.

DIES THAT DON'T "DIE YOUNG"



How a wire manufacturer speeds output and saves by using a Pennsalt Cleaner

"Our wire drawing dies aren't lasting as long as they should," decided the production men in a leading steel mill. "And tungsten carbide dies are getting harder to replace, now that expert die makers are scarcer than hen's teeth."

What to do?

A Penn Salt representative helped find the answer . . . better cleaning of the wire before drawing. After studying the problem, he suggested using the one of our series of Pennsalt Cleaners best suited for this job.

Success! Tungsten carbide dies in this steel mill now last 15-20% longer. There is less scrap loss and less scratching of wire. Rusty wire, requiring reprocessing, has been practically eliminated by dipping the wire first in a Pennsalt Cleaner solution and then in lime, before drawing. And, in addition, cleaner costs have been substantially reduced by comparison with the former metal cleaner used.

Most important of all, the longer die life, lower scrap loss and elimination of rusty wire . . . achieved with the aid of this Pennsalt Cleaner . . . helped *speed up production* of wire rope and other wire products vitally needed for Defense.

Today Pennsalt Cleaners are helping to speed up Defense in many other ways . . . by saving time, labor and materials in plants making metal parts for airplanes, tanks, naval craft, guns and other munitions.

There's a Pennsalt Cleaner designed to meet practically every kind of metal cleaning problem. What's *your* specific need in a metal cleaner? Our technical staff, backed by adequate supplies of all Pennsalt Cleaners, is at your service. Phone, wire or write our Pennsalt Cleaner Division, Dept. S.

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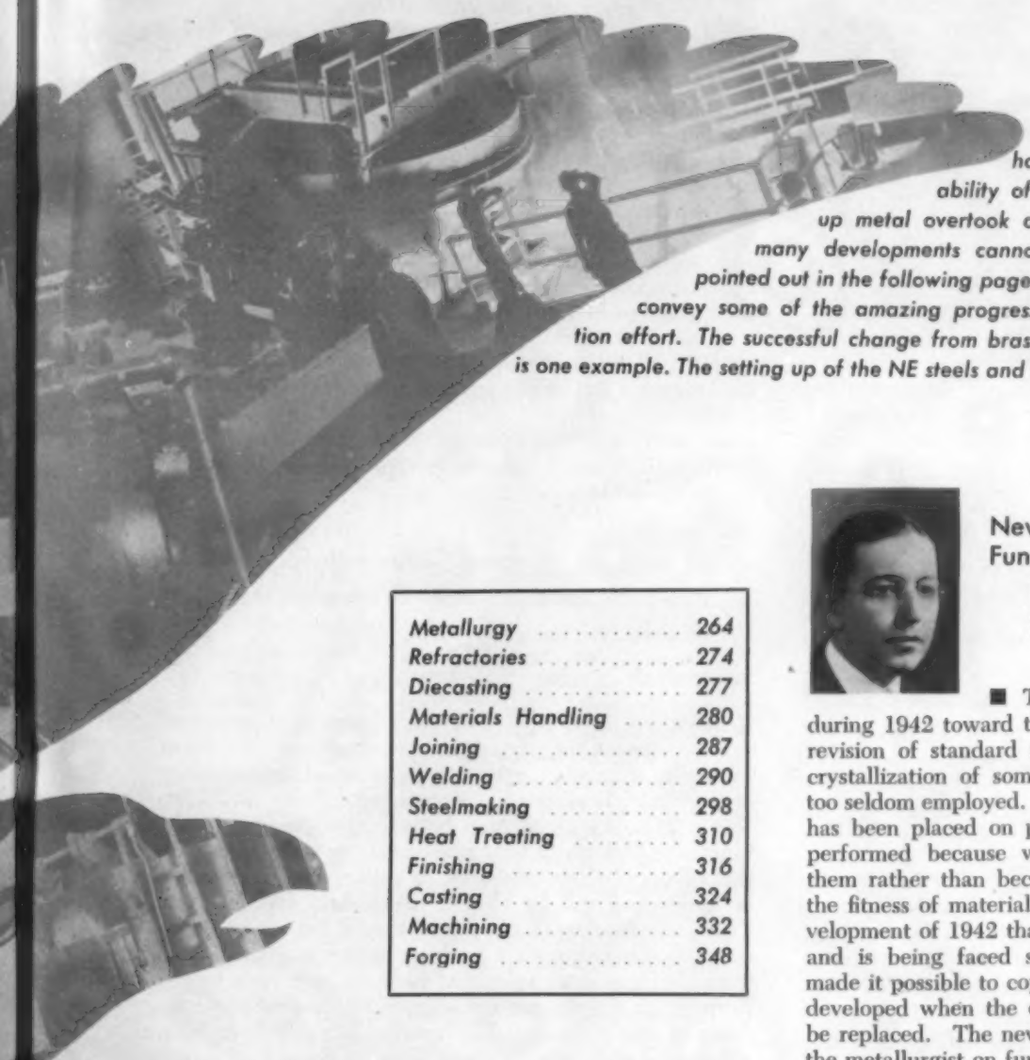
War accelerates TECH

CHNICAL PROGRESS



Some evidence of the technical advances in metalworking can be had from the fact that in 1942 the ability of our war production plants to chew up metal overtook our ability to produce metal. While many developments cannot be described at this time, those pointed out in the following pages of comments from industrial leaders convey some of the amazing progress that has grown from war production effort. The successful change from brass to steel in artillery cartridge cases is one example. The setting up of the NE steels and their successful application is another

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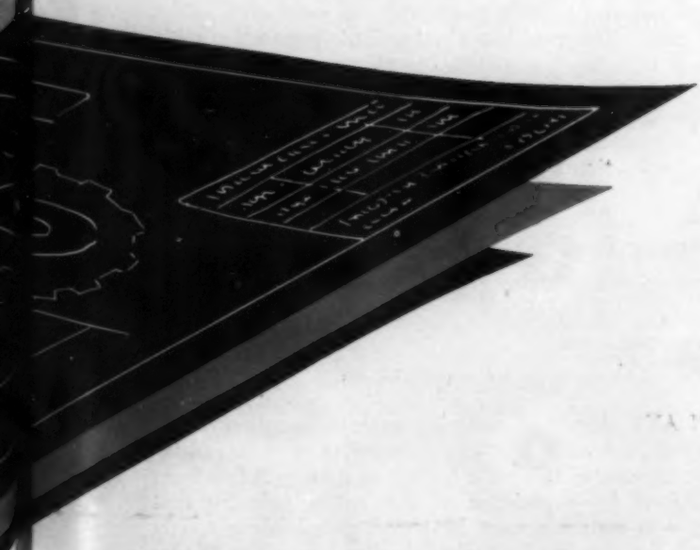

New Steels Focus Attention on Fundamental Metal Properties

BY ALVIN J. HERZIG
Chief Metallurgist
Climax Molybdenum Co., Detroit

■ THE CONCENTRATION of effort during 1942 toward the production of armament and the revision of standard steel specifications have forced the crystallization of some metallurgical concepts heretofore too seldom employed. In the past a great deal of emphasis has been placed on physical tests which were faithfully performed because we know so well how to perform them rather than because these tests precisely described the fitness of material for service. It is an important development of 1942 that this situation has been recognized and is being faced squarely. The new concepts have made it possible to cope with the complex situation which developed when the old series of standard steels had to be replaced. The new viewpoint focuses the attention of the metallurgist on fundamental characteristics and not on tests whose relation to performance is obscure at best.

Recognition of the true significance of fundamental properties clears the way for full appreciation of the vital role which residual stresses play in the attainment of improved service from metal products. It can be predicted that when this trend in metallurgical thought is more fully advanced, the use of favorable residual stresses will become the means of attaining service characteristics now considered impossible.

Conserving Alloying Elements Produces NE Emergency Steels

BY EDGAR C. BAIN
Assistant to Vice President
United States Steel Corp., Pittsburgh, Pa.

■ SCARCITY of material necessitates "cutting the cost to fit the cloth". The better the tailor, the more ingeniously is the cloth allotted to make the skimpy garment adequate. American metallurgists have

been resourceful in tailoring their steels to make available supplies of alloying elements go as far as possible. By sparing the alloy where it matters little, we have more for the war equipment that needs it.

Even in the days before Pearl Harbor many knew well enough (1) that the usual mechanical properties were exceedingly similar among the constructional steels of comparable standardized specifications if treated in section appropriate to hardenability; (2) that steels carrying a little of many elements hardened more deeply than those with a relatively large content of one or two; (3) that extra hardenability and related benefits were contributed (though not always fully utilized) by the "extra specification" (tramp) elements brought irregularly into steel by scrap; and (4) that a score of fine, medium-alloy steels would become available thereby with only a moderate drain on the alloy stocks. Somewhat fewer realized how good plain carbon steel is, if well treated in small section.

There remained then only the task of drawing up workable specifications for these not-wholly-new steels covering a series of hardenabilities. The result—the NE steels. In hardening steels of minimum requisite hardenability it is well to remember that drastic media such as violently stirred liquids must produce steep thermal gradients within the metal to be effective, and that, wish as we may, the laws of conduction still control. Thus a steel with a Jominy test figure of 9/16-inch, which will harden through about a 2-inch round in well-stirred oil, will only harden through a 2¾-inch round in water. An infinitely rapid quench only hardens it through a 3¼-inch round.

60 Mill Heats of NE Steels Show They Save Half Alloy Content

BY G. C. RIEGEL
Chief Metallurgist
Caterpillar Tractor Co., Peoria, Ill.

■ AS ONE of the first to advocate use of residual alloys in steel manufacture, Caterpillar Tractor Co. began testing of mill heat quantities of the NE steels even before they had been coded with the NE symbols. Since Pearl Harbor, our firm has consumed some 60 mill heats of the NE steels. Due to troubles in shearing caused by excessive hardness as hot rolled to shafting sizes, we have eliminated NE 8447 from our specifications. To avoid cracking when quenched in oil, we were forced to time quench in hot oil. For these reasons, we have been reluctant to use the high manganese, high molybdenum combinations of the NE steels. This means we use none of the NE steels in the 8200 to 8500 series.

NE 8600 series has proved very satisfactory, NE 8620 being an excellent alternate for SAE 4615 or 4620. Machinability is equally good. Hardness of carburized parts "as quenched" ranges from 57 to 67 rockwell C. Tempered to 400 degrees Fahr., hardness ranges from 57 to 60 rockwell C. NE 8630 now fulfills requirements formerly specified for SAE 4130 with a higher notch toughness and cold bend at 50 rockwell C than either SAE 4130 or 3130. Other satisfactory substitutions include NE 8024 for SAE 3115; NE 8724 for SAE 4820; NE 8739 and 8740 for SAE 3140, 3240, 2340 and 2345; NE 8749 for SAE 4150. Cumulative effect of the many small alloy contents in these steels appears to enhance heat treatment to the point where at least half of the alloy content formerly thought necessary can be saved.

Antifriction Bearing Makers Cut Alloy Content in Steels

BY CARL T. HEWITT
Chief Metallurgist
The Fafnir Bearing Co., New Britain, Conn.

■ THE NEED for standardization of existing steels as well as the possible necessity of using substitute steels was early appreciated by the antifriction bearing manufacturers. Nickel and chromium were becoming critical and the future held prospects of drastic reductions in their use. In June, 1941, work was initiated that resulted in the reduction of the number of chromium bearing steel analyses from 25 to 3, and the formulation and adoption of a nickel-molybdenum carburizing steel materially lower in nickel content. At the same time extensive test procedures were instituted, whereby substitute steels were to be made, fabricated and tested for quality against regular material. This necessarily was a long-time program but results are now being tabulated.

The scrap situation has caused some alarm among steel users, but the mills seem to have this situation pretty well in hand and are doing a real job in spite of the bad condition.

Boron Becomes Important Substitute for Strategic Elements in Steel Production

BY NORMAN F. TISDALE
Molybdenum Corp. of America
Pittsburgh

■ DURING THE past year, there were three important developments in the advancement of metallurgical science: First, the correlation between the effect of hardenability of different elements as demonstrated by Dr. M. Grossman. This has given us a better understanding of the functioning of the common elements we use. Second, the adoption of specifications to utilize low percentages of alloys and still be able to meet rigid specifications. Third, the development and adoption of the use of boron as a new element to meet engineering specifications. Sufficient heats of steel have been made in large open-hearth furnaces to familiarize ourselves with the proper handling of this element. The results obtained have been sufficiently consistent to place boron in the roll of a new alloy which can take its place with the most used alloys of the past. The most important point in connection with boron is that the raw material is plentiful in the United States and since it is possible to partially substitute boron for specific uses in heat-treated steels for some of the other alloys, the supplies of which we are rapidly depleting, it is a timely contribution to our national war effort.

Necessary Testing Limits Use of Substitute Alloys in Manufacture of Aircraft Engines

BY R. L. HEATH
Chief Metallurgist
Allison Division
General Motors Corp., Indianapolis, Indiana

■ IN ANY change of materials such as adoption of the NE steels, the aircraft engine industry must do a considerable amount of full scale testing of parts. It has been established by experience of the entire industry that changes in materials must be tested completely not only in the laboratory but by trial production lots and finally by

actual engine testing of the parts as a minimum program.

Aircraft engine manufacturers are responsible for the performance of their product in the field and the use of alternate steels is entirely the manufacturer's risk. Aircraft engines, and even different models of the same engine, are so different that there can be no comparison of the duty of the parts, so for those who are inexperienced, *it is well to remember that the experience of one manufacturer may not necessarily mean anything to another manufacturer.* The most important contribution I make at this time is to emphasize that the specialized nature of aircraft engines with their high performance and their low weight per horsepower demands extreme caution and a considerable amount of careful testing of any alternate material. Each aircraft engine manufacturer already is hard at work investigating alternate materials along the lines of attack mentioned here. Such testing necessarily is quite time consuming. So while many tests are under way, few are yet completed.

Many Substitutions Successful In Steel Strapping Machines

BY ADOLF LARSEN
Vice President in Charge of Sales
The Gerrard Co., Inc., Chicago

■ THE NEW Controlled Materials Plan will affect machine production in many ways but some substitutions already have been made. Round steel strapping machines are about 99 per cent metal, principally steel. Their forgings, castings, cold rolled bars, alloy and tool steel, bronze bushings, screws, pins, nuts, washers must be procured with high preference ratings or else are unobtainable. The manufacturing question resolves itself into using less scarce metals for those which now are scarce or restricted. Case-hardened steel bushings are being substituted for bronze Oilite bushings; molybdenum steels will be used in the place of those containing nickel and chromium; spring steel will replace phosphor bronze springs; and steel nameplates are being used in place of the scarcer brass nameplates. Because of the terrific frictions imposed on these machines, it is next to impossible to substitute other steels or metals for the steels we now use. Nor will plastics, wood or other materials suffice for strength and wear.

Wooden containers for holding the coils of round steel strapping are being produced now instead of the spun steel containers used heretofore. Our machine production is now confined to about three models instead of ten. All go directly to war producers and government users.

War Demands Force Many New And Successful Metal Substitutes

BY R. H. HARRINGTON
Research Metallurgist
General Electric Co., Schenectady, N. Y.

■ WAR CONDITIONS do not allow disclosure of some of the most interesting developments in alloys and in process and fabrication metallurgy. That the past year has given great impetus to metallurgy is witnessed in part by the substitution of the NE steels for the alloy steels; molybdenum high-speed steels for tungsten in tool steels; manganese steels for stainless steels in nonmagnetic applications; the miraculous increase in the rates of production of magnesium and aluminum for use in their respective alloys; the use of silver for at least part of the tin in solders; the use of silver in place of copper in bus bars, etc; the use of alloys of copper-cobalt-beryllium and copper-chromium-beryllium (containing 0.4 and 0.1 per cent beryllium respectively) to replace tin bronzes and the use of the former in place of the 2 per cent beryllium - 98 per cent copper alloy to ease the demand for beryllium; the expanded use of zinc and of lead alloys for diecastings as well as in sheet form; new alloys for high-temperature service; and new compositions and heat treatments for alloys of aluminum, magnesium, copper and zinc, yielding properties and economics superior to any available a year or two ago.

Low-temperature aging treatments for cold-rolled brasses, bronzes and cadmium-copper alloys increase the tensile properties and endurance limits so these materials can serve under heavier loads or with decreased cross-sectional areas, resulting in the saving of alloy or else better performances. The surprising and most encouraging point is that many of the substitutions and new developments accomplished by virtue of necessity are here to stay, since they yield better performance and economies than their predecessors.

"Tungsten Saves Tungsten" When Carbide Tips Salvage Worn-Out Tools and When Carbides Replace High-Speed Steels

BY PAUL H. MILLER
Chief Engineer
Carboloy Co., Inc., Detroit

■ MOST IMPORTANT is the growing appreciation that a pound of tungsten in a carbide-tipped tool, die, etc., will do many times the work of an equivalent amount of tungsten in high-speed steel. Carbide tools were originally adopted because they provided an increased output of war equipment per man hour and machine hour. It is only during the past year that the possibility of savings in strategic materials inherent in the use of carbide-tipped tools has become more generally appreciated. Today many organizations are even tipping high-speed tools with carbide in order to increase their useful life. Salvaging of otherwise worn-out tools is done by tipping them with carbides, the tips being brazed to the tools so as to re-establish original tool dimensions.

Classifications of tools now extensively carbide tipped have grown to include roller turner tools, shaper and planer tools, etc. Operations formerly considered outside the range of carbide tool applications are now taken in stride. Such work as machining steel parts involving interrupted cuts fall into this category. Metallurgical advances have contributed but mainly responsible is the vastly expanded "know-how" in putting carbide tools to work. Improved understanding of such fundamental factors as speed and feed selection coupled with such tool design innovations as the shear type tool with an extreme negative back rake have made much of this progress possible. For example, this shear type tool contributed extensively to solving the difficult job of machining extremely tough castings of high impact strength—a job that would not have been possible without the present knowledge of carbide practice in steel cutting. A beneficial development is standardization of major carbide tool designs for this places the manufacture of such tools on a mass production basis, conserving man power, enabling the use of workers of lower grades of skill on automatic and semi-automatic machines, and enabling further reductions in cost and price of carbide tools.

War Accelerates...Technical Progress

METALLURGY

Induction-Hardened Plain Carbon Steels Answer to Alloy Shortage

BY HARRY B. OSBORN JR.
Research and Development Engineer
TOCCO Division
Ohio Crankshaft Co., Cleveland

■ WARTIME problems have served as a challenge to the men responsible for developing new and better ways of meeting today's production needs. Surface hardening by induction is a development that obtains the desired metallurgical (heat-treating) results by utilizing high-frequency current as a source of energy for heating to produce the desired magnitude and depth of hardness. Too, the effect can be localized or confined to just those surfaces which must be treated.

As this modern process for induction hardening comes closer to being perfected, it becomes possible to maintain the correct structure of the metal core and to practically eliminate scale formation and distortion. In today's mass production, the exact duplication of electrically heat-treated parts can be maintained automatically, thus eliminating possible rejects resulting from rigid inspection and test requirements involved in all war production work. Hardening machine units are now designed to be located directly in production lines in order to reduce handling and hauling time and facilitating straight-line production methods in the heat-treating department. Scope of induction hardening operations continues to expand. One factor of increasing importance is that it can be used to produce parts from plain carbon steels that give service performance equal or better than parts from alloy steels. Thus the method has important possibilities in helping relieve the effect of alloy steel shortages. At least one machine tool manufacturer has found the answer to his material procurement problems—use induction-hardened plain-carbon steels and forget about alloy steel shortages.

Powder Metallurgy Products Used By Armed Forces, Medical Science

BY CHARLES HARDY
President
Hardy Metallurgical Co., New York

■ FIRST AMONG the outstanding developments in powder metallurgy during 1942, is the recognition that dense machine parts of high physical characterists can be made from metal powders to very close tolerances and can be produced economically. Second is commercial production on a large scale of alloy powders such as brass powders, bronze powders, aluminum alloy powders, etc. This development has increased the applications of metal powders appreciably. Third, is full realization by the Army, Navy and Air Force that powder metallurgy is of great value to our war effort, and the adoption of powder metallurgy for numerous applications.

Metal powders also find an outlet in welding and brazing work, in chemical welfare and in medical science. While little specific information can be had now, the fact remains that millions and millions of pounds of metal powders are being produced. Many millions of parts are made therefrom, and further outlets are being found. The war effort has stimulated production of a great many new products by synthesis. Metal powders such as copper, iron, silver and nickel, either as pure elements or combined with other elements, are widely used as catalysts. At end of 1942, demands for metal powders far exceeded production capacity. An increase in facilities is possible only after long delays in obtaining equipment.

Thus there is a great need for iron powder. Unfortunately the term "iron powder" does not clearly convey the real need. Iron powder is available at prices from 5c to $1 per pound. While a 5c iron may answer the need of one user, another might require the $1 per pound type. Clarification of qualities of iron powders, economical production on a quantity basis, what iron powder is needed by each class of use—all need further attention.

Need for Different Types Limits Powder Metallurgy Applications

BY GREGORY J. COMSTOCK
Stevens Institute of Technology
Hoboken, New Jersey

■ DURING the past year the most noteworthy advance in industrial powder metallurgy has been the application of specialized metal powder products to war production and the expansion or rearrangement of production facilities to meet these demands. Incident to this is the substitution of metal powder parts for those normally made by fusion and machining as a means of increasing production, releasing standard machinery for other work and conserving metal by the elimination of scrap. Careful surveys have been and are being conducted with a view to ascertaining the possibility of making still further applications of powder metallurgy as a means of utilizing secondary or substitute metals and alloys.

Probably the most important feature of the present situation in the urgent necessity for expanding the domestic production of iron powder. The chief difficulty in promptly accomplishing this seems to be associated with the apparent need for the quantity production of a number of quite different types of iron in powder form to meet the requirements of the specialized applications and practices of the individual fabricators of parts. Were it found possible to economically produce a sufficient quantity of a single type of iron powder which would be satisfactory for all purposes and to all users, this problem would manifestly become much simpler and far easier to solve.

There has been a material and timely increase in the production of nonferrous powders—notably brass and other alloys. Interest in the possibilities of industrial powder metallurgy remains high. It gives no indication of being in any way diminished by the necessary secrecy which must surround many applications of metal powder practice in war work.

Many Changes in Bearing Metals, Methods Meet War Demands; Marine Bronzes Aided

BY E. R. DARBY
Director of Research
Federal-Mogul Corp., Detroit

■ SHORTAGES in primary metals are a principal concern in the bearing industry. Tin, copper and cadmium are most serious, and their conservation is complicated by the steel situation. During the past year, lead-base alloys with little or no tin are replacing tin-base bearing linings. Except for lead-calcium and similar alloys, these can be made almost entirely of secondaries and provide an economical use for tin base metals contaminated with lead.

Now, Here's A REAL Dictator!

WHEN it comes to dictating, the great American consumer has them all beaten! As far as he's concerned, getting the best is very simple.

You just ask for it!

But supplying the best is not a simple matter for the manufacturers on whom this great dictator is casting his shadow—especially in the case of the new products he is expecting as soon as peace is declared.

Automobiles at half the cost, that go twice as far to the gallon! Houses that cost no more than a good car, but with all the conveniences of a palace! Household equipment that will be compact and indestructible! Air conditioning, radiant heating, television, electronic household controls...

And priced so that the average American can afford all of them!

American industrial ingenuity *will* give the consumer what he wants. But it will take revolutionary practices. And often the use of apparently fantastic materials.

Of course the war has brought about the eager testing of every material that research and metallurgy could devise. And many of these substitutes have earned a definite place in the field of metallurgy.

But which material? Under what circumstances? For which specific application?

Revere can help answer many of the questions that beset industry. For just as industry in the future will not be restricted to the traditional materials, neither will Revere. Since the war started, in addition to widening still further the uses for copper and its alloys, Revere has gained wide experience with the light metals, and has developed wholly new kinds of alloys with important properties that can cut manufacturing costs for many industries.

With this great expansion in the range of Revere metals, you can be sure of singularly impartial service from Revere. Today, the copper industry is working all-out for Uncle Sam. No copper is available except for winning the war. But post-war planners with specific problems in metals are referred directly to the Revere Executive Offices in New York.

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War Accelerates...Technical Progress

METALLURGY

Emergency bronze specifications with lower tin contents and higher impurity limits now free large amounts of virgin copper and tin for other purposes. Improved melting and casting processes have made these emergency alloys highly satisfactory in physical qualities even though they use a greater percentage of secondary metals. Cadmium-silver-copper alloy and cadmium-nickel alloy, though still used to some extent in linings for steel back bearings, have been replaced by copper-lead, silver or lead-antimony tin-arsenic linings. A new continuous process puts a metal powder copper-lead bearing surface on a steel strip, saving much metal formerly wasted. The bearing surface may be applied to both sides of the steel strip if desired.

Tin content of solder for bonding purposes has been drastically reduced. For bonding lead-base alloys to steel and bronze bearing backs, solders with less than 20 per cent tin are the rule, often a 4 per cent tin, 10 per cent antimony composition is used. A recently developed surface treatment enables cast iron to be used as a bearing back with the lining bonded by solder. Such backs may soon replace bronze in certain heavy lined bearings.

In marine castings, aluminum bronze for propellers and other under water parts is being replaced by high strength brasses containing less aluminum and somewhat more manganese and iron. To prevent corrosion, a long life inhibitor has been developed which when attached to the propeller reduces effect of sea water attack.

Faster Processing Equipment Speeds Wire Production

BY HENRY C. BOYNTON
Consulting Metallurgist
John A. Roebling's Sons Co., Trenton, N. J.

■ MORE WIRE is the call from the War fronts. Many manufacturers have doubled their production capacity. Every roll in the hot mills, every block in patenting and drawing departments is being driven at top speed to turn out more wire for Uncle Sam's soldiers.

An innovation deserving mention is closer control of all heating, soaking and cooling cycles. In soft steel, one rod pickling followed by closely controlled scaleless heating and cooling is almost universal. For hard steel, control is even closer. The heating medium may be gas, electricity, lead or salt, and cooling may be in air, lead, lead alloy, salts or oil—time being controlled in *seconds* not minutes.

Faster pickling is being facilitated by continuous pickling of full-sized bundles instead of single strands. Faster baking with forced air is often used, also the still faster "flash bakers". Heating of pickling solutions by internally fired tunnel burners is replacing steam. High-speed many-holed drawing machines are rapidly replacing the slow single blocks and making surprisingly good, uniform wire. Such continuous machines demand precise control of pickling, coating and lubrication. No rust on wire from the driers is a desideratum. "Bruntonized" wire for aircraft and marine uses is increasing by leaps and bounds. Lead alloy coatings are replacing much hot galvanized wire.

In the nonferrous field, an outstanding feature is the change of ASTM standard specifications for *annealed* copper rods and wire, raising minimum conductivity of annealed rods and wire from 98.6 to 100.0 per cent, giving engineers an increase of 1.82 per cent to use in design of new electrical machinery. Lead alloys are substituted for the usual hot tin dip before insulating copper wire, saving tin.

Advanced Heat-Treating Equipment Makes Better, More Uniform Wire

BY KENNETH B. LEWIS
Consulting Engineer
43 Midland Street, Worcester, Mass.

■ ONE OF THE notable trends in wire practice in recent times is the tightening up of control on heat treating operations, both batch and strand. The bell type furnace has made heavy inroads. Uniformity of heat control from top to bottom of the charge has improved in response to more sensitive instruments and also as a result of forced circulation of the furnace atmosphere through a defined path, which has not only improved the top-to-bottom uniformity, but also nicely leveled off the differences between outer and inner sides of the stacked bundles. This has been extremely welcome in many products, and a blessing in weaving wire, in which the slightest degree of nonuniformity is magnified into unsightly stripes in screen cloth.

Better sealing and atmosphere control have brought about a situation which has long been the dream of the wire maker. He can now take dry-drawn annealed wire direct to intermediate machines and redraw it in its original coating, not occasionally as a stunt and with heavy rejections, but as an established practice.

In strand annealing, the new technique of heating wires through their own resistance to the passage of electricity has made further commercial progress. As a patenting method, this technique with its novel quenching cycle produces a structure in which the microscope is totally unable to show any vestige of ferrite or of carbide plates. In fact, the word "structure" can scarcely be applied; "chaos" is a better term. Resulting properties include a higher tensile for a given torsion, and a notably higher degree of uniformity in torsion test.

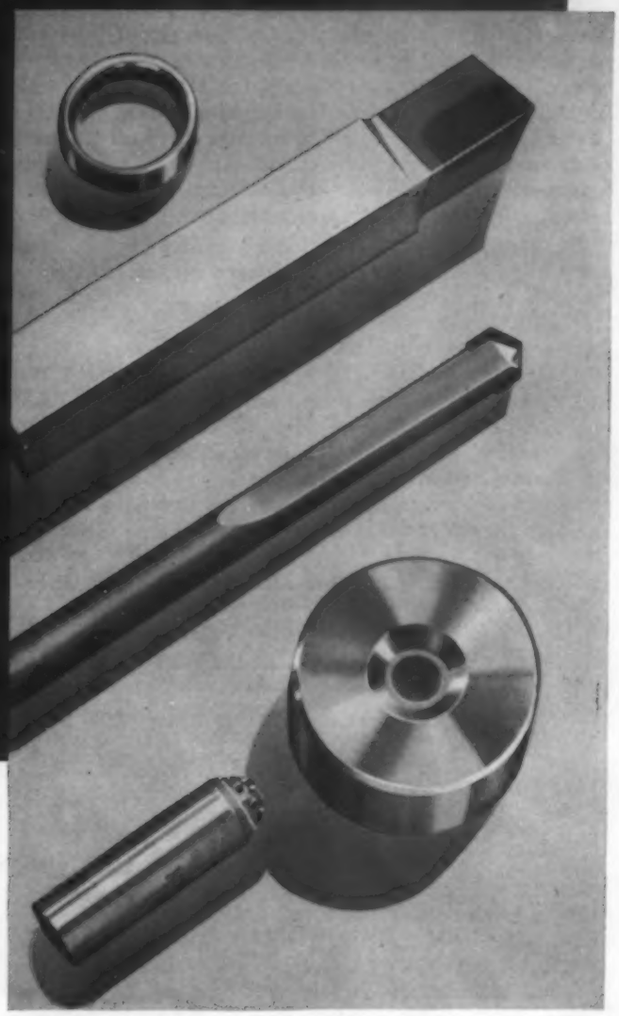
Industrial Applications of Silver Are Greatly Enlarged by War Requirements

BY R. H. LEACH
Vice President
Handy & Harman, New York

■ IN SPITE of curtailed production of many products, the use of silver brazing alloys has been greatly accelerated by widespread application to war production work. Among the important uses of silver brazing alloys is the joining of piping in our transport and fighting ships. Such lines as salt water, oil, steam, hot water, sprinkler, drain, condenser, vacuum, fresh water, waste and refrigerant are being brazed to speed up piping construction, save metal through the use of slip type fittings. Too, the thinner walled piping required reduces dead weight. Bulkhead connections, pipe fittings, flanges and expansion joints are other important parts where this kind of brazing is used. Another important job just starting is the joining of terminal tubes to enclosures for electrical systems of fighting ships.

On tanks, these alloys are used in gun firing mechanisms, electrical equipment and instruments, and for such work as joining brass filler connections to water tanks for

Use all 5 Ways to STEP UP War Production . . . With Carbides



1. Cut Metals Faster! . . . Carbide tools commonly double the volume of metal removed per hour. Cut wide range of material, from "tough" armor plate to "soft" plastics. Continuous or interrupted cuts. Adaptable to most old machines, as well as new. (Catalog GT-142.)

2. Dress Grinding Wheels Easier! . . . Diamond-Impregnated Carboloy dressers make diamonds do a full day's work every day! No time out for remounting. No lost diamonds. No "pampering" temperamental stones. Diamonds held permanently in place. Stocked in 3 sizes for wheels up to 42" diameter. (Catalog GT-142.)

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4. Draw Metals Better! . . . Draw, size, extrude your metals through carbide dies for better finish, greater accuracy, larger output, more continuous operation. Use for wire, bar, tubing, sheet metal. Outstanding for cartridge cases from .30 cal. through 105 mm. (Manual D-113.)

5. Install Equipment Quicker! . . . When installing new equipment, wiring and piping, or relocating present machines, carbide masonry drills drill holes 75% faster in concrete, brick, tile, porcelain, plaster. (Leaflet GT-103.)

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TRADEMARK
TOOLS • DIES • DRESSERS • CORE BITS • MASONRY DRILLS • WEAR RESISTANT PARTS

storage. On millions of shells and bombs, such parts as exploder tubes, fuse seat liners, adapters, nosepieces are being brazed with silver alloys for strength and leak-tightness. Ordnance work also includes brazing jackets on water cooled and air cooled machine guns, solenoid housings on firing mechanisms of anti-tank guns, gun sights, end plates of machine gun magazines and many other jobs where small parts must be reliably joined.

Large quantities of silver are going into airplane bearings. Fine silver is plated on the bearing shell to a thickness of about 0.025 inch. Reflectors are also being silver plated, this material replacing copper, nickel, cadmium and chromium on many applications. Tin-lead soft solders have given way to silver-lead solders for some uses. Some silver wire is being used to replace copper in winding small motors. Silver is also used in medical work for suture wires and plates and in making surgical instruments and cauterizing devices. It is used in a pure or fine state, in alloy form and in powdered metals mixed with graphite, tungsten, molybdenum and nickel to make electric contacts for many kinds of service. All these indicate a tremendous growth in the industrial importance of silver.

Expands Use of Zinc To Replace Tin as a Coating for Fine Wire

BY B. L. McCARTHY
Chief Metallurgist
Wickwire Spencer Steel Co., Buffalo, N. Y.

■ WAR HAS produced some drastic changes in wire mill products, over emphasizing production of some types and nearly eliminating others. Music wire is in demand, and remarkable success is being encountered in employing domestic rods for this purpose as a substitute for Swedish music wire rods. Signal Corps demands have resulted in some interesting developments in fine galvanized wire. Much of this material is being cold drawn from wire galvanized prior to cold work. Indications are that zinc coatings will be used to a large extent in the future as a substitution for tin coatings on fine wire.

War demands for large quantities of rope wire are playing an important role in present wire mill production. Quality of steel from which the present wire is being drawn is holding up well in the face of a serious scrap condition. In this respect, the patenting treatment is playing an important part as a conditioning treatment for high carbon wire prior to drawing. Particular emphasis is being placed on the need of close attention in the patenting treatment.

Considerable importance can be attached to new developments in cleaning and wet techniques. New solutions used as a substitute for lime on one and two-hole operations and to compliment lime on heavier reductions are proving of considerable value, as are also new coppering and liquor coating reagents.

Shortages Focus Attention on Conserving Alloys by Use of New Combinations

BY G. K. HERZOG
Electro Metallurgical Co.
New York

■ A NEW austenitic steel saves both chromium and nickel by replacing most of these elements with manganese. Designed specifically for aircraft and similar structures, it combines high strength with low overall weight. The manganese used, although strategic, is considered less critical than chromium or nickel. If it can be painted or other wise protected against atmospheric corrosion, no chromium is needed in an austenitic, 16 per cent manganese steel. Adding only 3 per cent chromium, greatly increases its resistance to progressive rusting. If it contains only 12 per cent chromium, resistance to atmospheric oxidation almost equals that of 18-8 chromium-nickel stainless steel. All these austenitic manganese steels are low in carbon. As with the chromium-nickel austenitic steels, cold-rolling improves ultimate strength and yield strength of the high-manganese steels. A 16 to 24-hour stress-relief treatment at 200 degrees Cent. further improves yield strengths and ductilities. Those containing between 0.10 and 0.35 per cent carbon have strengths, ductilities, and welding and forming characteristics that are comparable to those of the best stainless steels.

Where corrosion resistance combined with strength comparable to that contained in 18-8 chromium-nickel steels is necessary, a composition approximating 18 per cent chromium, 6 manganese, 4 nickel, and 0.10 carbon proves satisfactory. It is predominantly austenitic, has good hot and cold-working characteristics. In this steel and other high manganese alloys, welding is facilitated because the manganese imparts hot ductility. This prevents cracking of the welds while cooling. Another steel that conserves alloys over the composition it replaces contains 23 per cent chromium, 4 nickel, about 3 manganese, 0.25 to 0.30 nitrogen, and low carbon. Despite the low nickel, the unusually high percentage of nitrogen makes the steel austenitic and its corrosion resistance and weldability are good.

Boron is especially important in saving alloys for its beneficial effect on the hardenability of steel is similar to that of other elements used to control the rate of transformation, yet minute amounts of boron are exceptionally effective. Additions of 0.001 to 0.003 per cent give excellent results while as little as 0.0006 per cent are reported to be definitely beneficial. Thorough deoxidation prior to the boron addition is necessary to prevent excessive loss of boron by oxidation. It also helps to limit losses of other alloying elements, therefore deoxidation is receiving particular attention. In deoxizing electric steel, it is becoming common practice to replace a part of the aluminum with calcium-manganese-silicon. Not only do the nonstrategic elements in this alloy help conserve aluminum, but its use tends to increase the ductility of the resultant steel.

Metals Conserved by Successful Use of Composite Contacts, New Contact Alloys

BY C. B. GWYN, JR.
Chief Engineer—Contacts
Fansteel Metallurgical Corp., North Chicago, Ill.

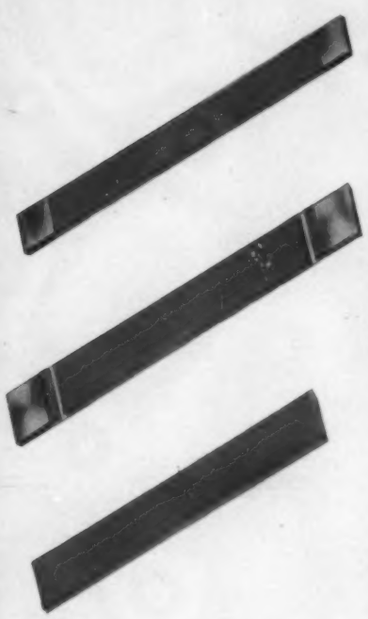
■ ELECTRIC contact materials restricted by supply or allocation include tungsten, silver and iridium alloys. Iridio-platinum contact alloys are now restricted to aviation magnetos and certain types of aviation voltage regulators. Platinum-ruthenium contact alloys have successfully replaced iridio platinum for voltage regulators, many types of aviation magnetos, and for sensitive instruments. Tungsten for electrical contact purposes may be had without restriction. Supply for this purpose is ample.

Silver, one of our most plentiful contact materials, is currently restricted, but pending legislation should quickly remedy this. Supply is ample.

Examples of compositions revised to meet war require-

Here's a **Superior** *baby —growing to a giant in war!*

THE SUPERIOR PROCESS FOR MAKING CLAD METAL



SuVeneer

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Born ten years ago—*today* serving in the vital economy of costly, critical materials—*tomorrow* a powerful contender for many metal uses when Victory is won!

To the modern engineer, SuVeneer clad metal offers many stimulating possibilities in planning for the future. The illustrated application for ordnance is contemporary, saving great amounts of copper—but you can as easily have stainless or any other metal SuVeneer-bonded with carbon steel in post-war years.

Superior engineers originated and developed SuVeneer clad metal. If you are working on "tomorrow," Superior will be glad to cooperate—glad to show you how SuVeneer's proved advantages can lower costs and increase the efficiency of your projected products!

SUPERIOR STEEL CORP
SUVENEER
1892-1942
CARNEGIE, PENNSYLVANIA

Superior Steel

CORPORATION

CARNEGIE, PENNSYLVANIA

ments are found in aircraft and tank relays. In similar civilian uses, fine or coin silver or silver-base alloys were suitable. However, due to the large safety factor required in the corresponding war equipment, alloys or admixtures having special arc quenching or nonwelding properties are necessary. One is mainly of molybdenum and silver. Many control units for war work are so sensitive, or must work in such rapid sequences or under such conditions of temperature, atmosphere and altitude as to require extremely close mechanical tolerances and often special shapes in the form of cones, rounds, balls, etc. The production steps required were not formerly considered feasible, but are now considered routine. To conserve vital copper, zinc, etc., many composite types of contacts with plated steel backings have been developed. Such composite contacts have only a facing of contact material.

Improved Bottom Construction Speeds Open-Hearth Operation

BY HUNTINGTON DOWNER
Manager of Sales
Basic Refractories, Inc., Cleveland

■ OVER 78 per cent of all the basic steel plants in the United States and Canada have been using Ramix for new bottom construction or for major hearth repairs. The experience of those steel makers with this high magnesia cold ramming mixture, first introduced to the American trade in 1938, has led quite logically to the all-Ramix hearth in open-hearth furnaces, a practice adopted some years ago for construction of basic electric furnace bottoms.

During the past year, 21 complete Ramix hearths have been installed in 11 basic open-hearth plants; that is to say without any fused material burned in over the Ramix. Such an installation puts the furnace in operation seven to ten days earlier than would be possible when using the conventional method of burning in magnesite and slag. Other important advantages include uniform composition throughout, no dilution of the magnesia content or contamination from slag or silica drip from roof-brick, saving of from seven to ten days of furnace fuel, a much lower labor cost as evidenced by the fact that such a hearth using 122 tons of Ramix has recently been installed in a 200-ton furnace in 48 hours' ramming time.

Refractory Substitutes Found That Perform Satisfactorily

BY C. E. BALES
Vice President
Ironton Fire Brick Co., Ironton, O.

■ THE REFRACTORIES industry has kept pace with the greatly increased demand for its products during the past year by running present equipment overtime and by a considerable increase in productive capacity.

Research work has been continued on an enlarged basis with the idea of increasing the quality as well as workmanship of all types of refractories. Considerable effort has also been devoted to developing substitute materials. For example, a siliceous ramming refractory has been developed which has successfully replaced a product formerly imported from Germany. This ramming refractory is used for ladles handling gray iron, malleable iron and electric-furnace steel. A super quality refractory cement has also been developed for brick lined ladles and for laying up cupola blocks in the melting zone and well of cupolas.

Due to the shortage of Indian kyanite, some expansion has been made in the production of domestic kyanite and the use of calcined topaz has been stimulated. The refractories industry occupies a position of vital importance in the war program and will do its share to accomplish final victory.

Refractories Output Increased; No Scarcity Now in Sight

BY FRED A. HARVEY
Director of Research
Harbison-Walker Refractories Co., Pittsburgh, Pa.

■ UNDER EXISTING conditions, new developments in refractories have to be held largely in abeyance. The new raw materials which might be required are either not available or are to be used only when absolutely essential. High alumina materials are largely under allocation but even so would probably not be used for new products.

It is greatly to the credit of the refractories industry that even under existing conditions there is no lost time in furnace due to lack of refractories for new construction or replacement. Deliveries are extended on new construction but even so refractories are usually well ahead of other essential materials. Production has been materially increased and has now reached a point where no scarcity appears to threaten.

Furnace Constructions Designed To Use Noncritical Materials

BY S. M. JENKINS
Building Materials Division
Armstrong Cork Co., Inc., New York

■ INSULATING firebrick walls for furnaces, ovens and heating equipment have been held together by an outer shell or facing, such as red brick, concrete or steel. The steel plate materials are required for more important war work. In a great many other places, the outside furnace walls can be constructed of insulating brick directly exposed, if laid properly. Some of the porous machine-sized insulating brick form an excellent bond if moistened to remove the dust and if laid with a very finely ground, good setting, insulating brick cement. An asphalt-base waterproofing, such as Insulmastic, can be troweled on about ⅛-inch thick. Upon drying, this gives an excellent air and water-proof wearing surface.

Further refinements in insulating firebrick constructions have been possible by the use of tailor-made arches. All insulating firebrick in such an arch are properly pitched so the labor of laying up is reduced. The last wedging brick installed is the same size as the rest of the arch brick and so produces the strongest possible key and the most practical distribution of pressure on the skewbacks.

For large furnaces and ovens operating at low temperatures, the flat arch and hanging wall construction of insulating firebrick are simplified by use of welded wire,

WHAT HAPPENED TO THE 4999th?

A TINY FLAW, a jammed gun, a boy's life's blood reddens the earth, out there in that leaden hail. Had someone blundered when the parts for that gun were made?

Five thousand parts make up that gun of his. Five thousand pieces of metal—yet only a single one need fail to cost his life so bravely given. Your neighbor's son or yours. Think now, what tremendous liability to tiny bits of metal!

What can *we* give? Only the patient work that moulds and toughens fit metal for his fighting. Only the craftsmanship that forms each part with absolute precision. Only our sweat to save his life, our toil to help him toward Victory.

This we can do. Metal is sacred—save it! This we can pledge. Each part, however small, shall move in the terrible motion of battle—true, sound and as nearly perfect as human skill and mechanical ingenuity can make it.

Such resolve controls the quality of each Empire bolt and nut—each bit of metal on which a soldier's destiny may ride. To manufacturing processes which insure maximum strength and greatest accuracy, we add the personal energy and care so essential to Victory.

Free posters for your plant's bulletin boards, reproducing this ad with an appropriate slogan in place of our signature, are available upon request. Write Russell, Burdsall & Ward Bolt and Nut Company, Port Chester, N. Y.

RB&W *Making strong the things that make America strong*

WHEELS of PROGRESS *for 1943*

GRINDING WHEELS, now more than ever, demand the most careful selection. Conservation should be the ever-watchful password in every foundry, toolroom, factory grinding department or machine shop.

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CONTROLLED POROSITY, FRACTIONAL GRADES, H9 VITRIFIED BOND, three of our many outstanding features, assure a definite start in this direction. Consult BAY STATE and be sure!

WHEELS of PROGRESS

BAY STATE

ABRASIVE PRODUCTS CO., WESTBORO, MASS. U.S.A.

rod and plate-fabricated construction. In comparing the weight of alloy castings usually used and the fabricated wire hanger construction, the light weight walls and arch weights are reduced to approximately 0.66 pound per square foot for perpendicular construction and about 1.3 pound per square foot for hanging arch. Due to the shortage of insulating firebrick for low priority constructions, some use of insulating concrete is being made. While not as good an insulator, it can give satisfactory results. As this material is hand mixed on the job, care should be taken that the workmen are properly instructed in mixing and ramming it into place.

Diecasters Change to Secondary Aluminum for Many War Items

BY BRUCE W. GONSER
Supervisor, Nonferrous Division
Battelle Memorial Institute, Columbus, O.

■ THE DIECASTING industry has been so concerned with production during the past year that there has been little time for new developments. Most changes have been in casting new war products and in using substitute or secondary materials rather than in process and equipment improvements. Civilian use of diecasting has practically ceased and all available capacity turned to war work. Consumption of zinc base alloys is consequently now less than that of aluminum diecastings. Ammunition components such as fuse bodies, windshields, ogives, booster cups and rotors use immense quantities of aluminum diecastings; also ardnance aircraft and naval equipment include many diecastings of aluminum. Zinc base alloys find application as diecast hand grenade bouchons, 20-millimeter fuse bodies, closing plugs for projectiles, nose pieces for float flares, and the like.

At one time it was considered essential to use only primary aluminum for most of these diecastings. But in the past year, the substitution of secondary aluminum has been quite general in spite of the difficulties encountered. The skill shown in making this successful change speaks well for the industry. As an example, ammunition parts formerly made from high purity 12 per cent silicon aluminum are now produced from a more available secondary alloy having 4 per cent copper, 9 per cent silicon.

Use of manganese base alloys and of brass diecastings has continued to increase, the former being used particularly in aircraft parts. A suitable die for casting copper base alloys is still a handicap to expansion in this field.

Die Steels for Diecasting Made Without Vanadium

BY R. P. KELLS
Chief Service Engineer
Latrobe Electric Steel Co., Latrobe, Pa.

■ RESTRICTED use of critical alloys has not inconvenienced diecasters much, for steelmakers are continuing to produce satisfactory die steels for diecasting. The curtailed use of vanadium has caused no hardship because of the advantages gained by increasing the molybdenum content. Principal function of vanadium in die steels was to elevate the coarsening temperature of austenite, thus effecting stabilization by preventing grain growth caused by accidental overheating in processing or heat treatment. The necessity of close heat control was long ago recognized by a large part of the diecasting industry which provided itself with the necessary equipment and facilities for maintaining the temperatures required. Fortunately, molybdenum has the ability to raise the coarsening temperature, high-temperature strength and creep resistance.

To conserve strategic elements, steels of low alloy content may be used for casting the low melting point materials such as zinc, tin and lead. However, diecasting aluminum and magnesium, or their alloys, requires steels of high alloy content because of the high casting temperatures involved, a typical analysis of dies for such work is 0.35 per cent C, 1.00 Si, 0.30 Mn, 1.25 W, 5.00 Cr, and 1.25 Mo. Special steels are required for casting copper base alloys because of the extremely high casting temperatures. The 8 to 15 per cent tungsten hot-work die steels with carbon content ranging from 0.25 to 0.50 per cent appear most satisfactory for this application. About heat treatment: Be sure that dies are heated slowly for hardening and are tempered thoroughly. The time consumed will be found to pay large dividends.

Use of Secondary and Remelt Aluminum Taps Important Supplies

BY A. D. WEIGOLT
Factory Manager
Precision Castings Co., Inc., Cleveland

■ THE ONE thing which stands out most this year in the diecasting picture is the facility with which the industry has adapted itself to the change-over from the high-purity aluminum alloys formerly used by the government and which were thought indispensable for satisfactory results, to the secondary or lower grade remelt alloys.

This change in material specifications enables us to tap a large reservoir of aluminum that is readily available but for which there otherwise would be only a very small or no market at all since nonmilitary requirements have been denied aluminum of any kind. This should go a long way toward easing the aluminum shortage situation for the aircraft industry and in this way contribute substantially to the war effort.

Magnesium Output Is Increased Several Hundred Per Cent in 1942

BY L. B. GRANT
Manager Production Control
Dowmetal Division
The Dow Chemical Co., Midland, Mich.

■ THE PAST year has seen unprecedented developments in the magnesium industry both in the manufacture of the metal and in its fabrication into structural products. New magnesium plants have been built in 1942 in practically every section of the United States. Combined output of these plants in 1942 together with those already existing is several hundred per cent over 1941. The magnesium industry is particularly fortunate in that all raw materials for production of the metal are available in this country in unlimited quantities. These facts put the United States in an enviable position regarding supply of magnesium for both war and post-war uses.

Sand castings represent the major tonnage of the magnesium products used in aircraft today. This fact necessi-

War Accelerates...Technical Progress

DIECASTING

tated a large expansion of the magnesium foundry industry. New foundries were built both by firms previously in the business as well as by newcomers in the field. Even these new foundries were not sufficient to meet the demand so several large iron foundries have been converted to magnesium with a speed and efficiency typical of American industry. The greatly accelerated demand for magnesium in 1942 parallels the tremendous growth of the aircraft industry because magnesium is being used in ever-increasing quantities in airplane structures. It is, indeed, fortunate that the magnesium industry has perfected magnesium and its products through years of development to a point where the use of magnesium in airplanes is both practical and economical.

Aircraft Engine Supercharger Impellors Diecast Successfully

BY CHARLES PACK
President
Doehler Die Casting Co., New York

■ ALL MATERIALS used in diecasting may be classed as strategic. Zinc, aluminum, magnesium and copper, the raw materials of the diecasting industry, are available only for urgent military requirements. Where zinc has been the metal most used, aluminum has taken its place as the leading diecasting metal for war production. The scarcity of aluminum has forced the diecasting industry to learn to utilize secondary aluminum alloys. As a result, the major portion of aluminum diecastings are now produced from low grade scrap metal.

Emphasis is on quality. Diecastings are now used on highly stressed aircraft parts where defects cannot be tolerated. By the intelligent use of the X-ray and fluoroscope, the diecasting industry is learning how to make sound and dependable diecastings. Development of a sound diecast impeller for aircraft engine superchargers is an example. Tests conducted on such impellers show a minimum bursting speed of 50,000 revolutions per minute and it is anticipated that such diecast impellers will soon replace forgings. More and more diecastings are helping to eliminate bottlenecks in war production by replacing the limited supply of forgings and screw machine products.

Aircraft Demands To Result in Larger Diecasting Machines

BY F. W. McINTYRE
Vice President and General Manager
Reed-Prentice Corp., Worcester, Mass.

■ THERE HAS been a steady, increasing demand for high-pressure horizontal-plunger diecasting machines for producing aluminum diecastings, especially for the aircraft industry. Even with this industry's low production compared with prewar automotive output there is sufficient saving over other types of aluminum castings to warrant initial die costs. Securing a more dense, stronger casting has enabled them to reduce the size of the casting in many cases.

A maker of small air-cooled gas engines required on portable equipment such as lighting units, power timber saws, fire pumps, etc., now finds he has sufficient quantities to warrant diecasting rather than the use of sand castings. There have been many substitutes made of high-pressure aluminum diecastings in place of steel and brass in ordnance work. Foreign countries purchasing equipment through Lend-Lease appear to have become more diecast minded. They are purchasing machines, dies and trimming equipment. Future normal demand for equipment of this kind in foreign countries is indicated.

Developments in sight point to larger machines and higher pressures for increased size of castings over those made in the past. These requirements have come from the aircraft industry. There is also a strong tendency to substitute plastic injection molded parts to replace critical metals. This demand has taken up the production of a great percentage of the machines that were formerly used on products not essential to the war program.

Rubber Industry "Stretches" Crude Supplies To Fill All War Needs

BY W. S. RICHARDSON
General Manager
Industrial Products Sales Division
B. F. Goodrich Co., Akron, O.

■ PRODUCTS of rubber are essential to the efficient operation of American industry. All of these products underwent, within the last year, the closest scrutiny from the angle of redesign so they use less rubber and still give utilitarian value. In addition, all phases of rubber compounding were explored to substitute any one of a number of chemical materials that can replace rubber.

The objective is to manufacture a product which, while not the best that could be made if natural or synthetic rubbers were freely available, would give sufficient service to avoid wasting rubber. As an example, it would be of no value to cut out 50 per cent of the rubber in an essential product and have it give only 30 per cent normal service. The aim was to cut out, say 50 per cent of the rubber, and have the product give 80 per cent normal service until synthetic rubbers become available in sufficient quantities to relieve the nation's tight rubber situation .

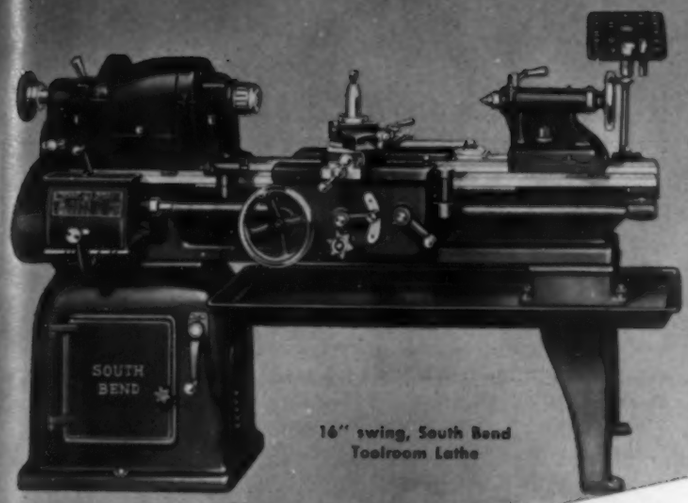
This industry generally succeeded in this to a marked degree during the past year, effecting tremendous savings in crude rubber. By doing this, it was possible to avoid making the manufactured product so scarce that essential industries would be handicapped by shortages of rubber products such as hose, transmission belting, conveyor belting, packings, molded goods, rubber-lined equipment for chemical processes, etc.

While existing products were passing through this reconstruction period, work was going on with Ameripol, a synthetic rubber, on the market in limited quantities for the last two years. Efforts are being made to apply it in the manufacture of rubber products so that American industry can be served if the nation's stockpiles of crude rubber are exhausted.

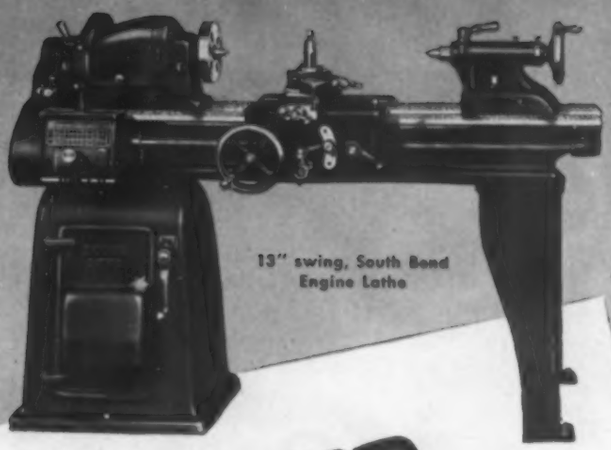
Late Design Improvements of Grabs Result in Safe, Speedy Handling

BY J. BRESLAV
Engineer
J-B Engineering Sales Co., New Haven, Conn.

■ UNTIL recently most hoist and crane buyers purchased this equipment without knowing whether or not it would be suitable. To increase materially the efficiency of hoists and cranes and greatly multiply the work which can be accomplished with them, special grapples were recently designed. These were produced with



16" swing, South Bend
Toolroom Lathe



13" swing, South Bend
Engine Lathe

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Time, material and manpower can be saved for vital work if you use the *right* lathe for every job. The matching of the job and the lathe has never been more important than it is today—in no other way can maximum production be obtained. Remember that versatility and precision are important in a toolroom lathe. For manufacturing operations, a lathe must also have plenty of power, speed and stamina.

South Bend Lathes are made in sizes and types that will efficiently handle a wide range of work. The Engine Lathes and Toolroom Lathes are made with 9″, 10″, 13″, and 16″ swings. The Turret Lathes have 9″, 10″, and 16″ swings. A copy of Catalog 100B describing these lathes will be sent upon request.

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Engine Lathe

9" swing, South Bend
Engine Lathe

Series 1000, 10" swing,
South Bend Turret Lathe

No. 2-H, 16" swing,
South Bend Turret Lathe

TRAINING HELPS

Write for Circular 21-C describing South Bend Training Helps—sound films, books, charts and bulletins on lathe operation.

Official U. S. Navy Photo

a view not only to merely permit lifting the object but to permit speedy gripping and release, to permit handling with a minimum amount of labor, to permit efficient storage and reclaiming with the minimum of space requirement both on the sides and above the objects lifted. Grabs now are available for very light loads or loads as high as 100,000 pounds.

Just as low and high-lift trucks use platforms for unit load handling, these grabs are being applied to containers so designed that they can be filled near the production machine, transported efficiently by a crane, then stacked one above the other interlocking for safety. Such containers when stacked and interlocked serve the same function as racks or bins for smaller objects. Not only have these grabs speeded up operations but they have increased the safety of handling.

Technological Advances Cited As Outstanding in Power-Truck Field

BY GEORGE E. STRINGFELLOW
Vice President
Thomas A. Edison, Inc., West Orange, N. J.

■ FOUR things stand out as the most significant advances in material-handling practice during the past year. These include: First—the application of dry-plate rectifiers to the charging of industrial-truck batteries. Second—the large-scale adoption of battery-powered hand trucks as adjuncts to the operation of standard industrial trucks. Third—the increased perfection in the use of fork trucks for handling wider and wider varieties of materials. Fourth—the increased emphasis upon 24-hours-a-day, 7-days-a-week operation of standard battery industrial trucks with the adoption of more highly perfected methods of battery exchange and battery maintenance.

These developments enabled our war industries to take advantage of the inherent high service availability of battery industrial trucks arising from the fact that the trucks themselves need not be tied up for maintenance work on the power units.

Wartime Handling Developments Change Assembly Methods

BY A. F. ANJESKY
Sales Manager
Cleveland Tramrail Division
The Cleveland Crane & Engineering Co.,
Wickliffe, O.

■ TWO PROBLEMS faced the materials handling field during the past year—that of finding substitutions for unavailable materials, and that of meeting handling conditions created by the greatly expanded war plants, expecially those in the aircraft field. The first problem was overcome successfully. Among the outstanding substitutions made was that of plastics for molded rubber items. So successful was this replacement that it is entirely possible that the substitution will be permanent.

In overcoming the second problem, it was necessary to develop equipment for buildings of unusually wide span —equipment having a greater handling capacity up to and including 10 tons, with cranes and transfer bridges operating on three, five, eight and more runways, with bridges also provided with interlocking mechanisms which would permit the operation of two or more cranes as one unit. This type of equipment is speeding production great-

ly in our aircraft plants. Multi-runway cranes of the underslung type have the advantage of being light in total weight, therefore, the total dead weight of such unit more closely approaches the weight of the load handled, resulting in lower horsepower for driving the crane down the runway and also permitting faster acceleration and deceleration with conventional control equipment.

Outstanding among other developments the past year is a method of assembling planes weighing 15,000 pounds and less on overhead equipment, using a new type of hoisting mechanism known as the stabilized hoisting unit. At present this unit is being applied in assembling dive bomber planes, permitting straight assembly line production. One stabilizing unit is used for each plane assembly. Thus assemblies can be propelled down the line, raised and lowered and tilted to provide proper working height for the workmen on the floor, eliminating platforms and ladders. In other words, the stabilized unit provides stability rotationally, laterally and longitudinally. It has possibilities of application in other plants, for instance, in handling ladles in foundries, transporting industrial X-ray equipment, handling welding heads on continuous welding operations and also as a positioner or welding fixture.

Cuts Use of Critical Materials By Reducing Weight of Equipment

BY F. J. SHEPARD, JR.
Treasurer
Lewis-Shepard Sales Corp., Watertown, Mass.

■ ANTICIPATING the present shortage of steel and other critical materials in the materials handling field eighteen months ago, engineering efforts of handling equipment manufacturers were turned to the problem of redesign, in an effort to reduce and eliminate so far as possible the use of hard-to-obtain materials. By careful analysis, some concerns reduced the weight of their materials handling lines by 25 to 30 per cent. Exhaustive tests made by research departments gave assurance of no sacrifice in strength and wearing qualities. The obvious advantage of the minimum parasitic weight in hand-propelled and operated lift trucks, portable elevators, and floor trucks is self-evident. It is felt that the industry thus has immensely improved the sales appeal of its products as well as materially reduced the amount of critical materials used in their manufacture.

Technological Advances Increase Use of Automatic Handling Units

BY E. W. SCHELLENTRAGER
Vice President
Atlas Car & Mfg. Co., Cleveland

■ DURING THE past year, technological advances helped to increase production tremendously. For example, steel mills were quick to accept a new automatic electrically-operated coke-weighing scale for blast furnace service, equipped with mercury-tube switches. The improvements made in the tripping mechanism of this unit eliminated possibilities of misregister. This coupled with the new arrangement which allows for adjustment of the tripping point without disturbing any part of the scale, or opening the main case, made these scales so simple and reliable that they are being used in practically all the new blast furnace plants recently constructed and under construction.

The use of power-operated cars for transferring materials from underneath one crane runway to another was also greatly accelerated during the past year. These cars are of all types, some operated by power through trailing cable, some by storage battery power and some by gas-electric power. Such cars were used for many years in the heavy industries, but there was a marked increase in the use of these cars during the past year because of improvements in the driving mechanism and electrical apparatus which have made these units extremely dependable.

Industry's Duty To Release Its "Expendables" To Carry on War

BY H. J. BEATTIE
Supervisor of Salvage
General Electric Co., Schenectady, N. Y.

■ IN BATTLE, "expendables" are those forces sacrificed to accomplish the objective. In industry, "expendables" might be considered those materials and equipment of no immediate use which can be released to bolster production's front lines. In view of the materials situation, it behooves industry generally to review its "expendables" immediately with an eye to releasing them for the war effort.

Our organization, for example, has several groups working on expendables. One is ferreting out surplus and inactive inventories, disposing them to government agencies which have been set up by the War Production Board to route the material into war production channels. Thus far, several million pounds have been moved this year. A second group is searching our plants and offices for "dormant scrap" such as obsolete machinery, equipment, tools, dies, fixtures, piping, wiring, etc. Last year's contribution actually shipped to steel mills, foundries and smelters amounts to over 1000 tons per month and is continuing at this rate.

A third group is handling production scrap and has stepped up salvage operations so that the materials are classified, processed, and readied for shipment within 24 hours of collection. A fourth organization, consisting of designing engineers, draftsmen, and methods men, is constantly developing new ways of reducing the amount of materials necessary in manufacture.

Truck Industry Exceeds Normal Capacity Several Times Even Though Expansion Slight

BY C. B. COOK
Sales Promotion Department
Elwell-Parker Electric Co., Cleveland

■ OPERATING under the control of the War Production Board Regulations L-112 and OPA, the power industrial truck industry during 1942 produced several times its normal capacity—a capacity that was developed through more efficient methods, rather than through expansion. Most expansion was not undertaken by old line companies who build electrics principally, but rather by the gas-truck manufacturers.

During the year, three electric-power truck manufactur-

War Accelerates...Technical Progress

MATERIALS HANDLING

ers developed battery-powered, hand-steered, non-rideable lift trucks. One hand-truck manufacturer began production of electric power industrial trucks. Placed on the critical list in June, 1941, the industry has been subjected to ceiling prices since Oct. 1, 1941, yet most of the manufacturers are located in highly competitive labor markets where other war industries are completing contracts not yet controlled by ceiling prices.

Practically 100 per cent of the industry's capacity is concerned with Army and Navy contracts and orders are booked for at least six months into 1943.

Safe and Speedy Handling Features Of Modern Open-Hearth Buckets

BY ARNOLD HOOPER
Manager of Bucket Sales
Blaw-Knox Division
Blaw-Knox Co., Blawnox, Pa.

■ OF THE many developments in the art of material handling in the steel industry, perhaps the most significant advance is typified by the wide acceptance of the heavy duty 2-line hook-on type open hearth slag clamshell buckets, in place of the single-hook type, heretofore used for intermittent hook-on service.

This unit permits the use of the slow speed main hook, as the holding line. The auxiliary hook, with its relatively high speed, is used for closing and opening the bucket, and, in addition, it assumes part of the hoisting load. Thus, the cycle is speeded up, and at the same time the combined gross load capacity of the hooks is utilized.

To provide maximum hook block travel for closing, the "open head" type is employed. The head pin is off-center to allow space for the closing line hook to descend into the bucket. Two closing lines to the hook-on yoke are used, so that the bucket can be supported entirely from either hook without twisting. The chain sling at the top of the bucket, for the hold line hook, also provides necessary slack so the bucket can settle down while digging.

Versatile Handling Units Speed, Integrate Production in War Plants

BY SAMUEL WUNSCH
Secretary and Mechanical Engineer
Silent Hoist Winch & Crane Co.,
Brooklyn, N. Y.

■ SPEED IS the motivating factor in the current situation of the hugely augmented volume of production of ships, planes, equipment and *materiel*, and the materials to produce all of these. To achieve a rapid rate of production, the method employed during the past year was invariably one form or another of horizontal expansion—spreading out over large areas, the whole comprising of a number of buildings, yards, areaways, roadways, and railways or shipways or both of the latter.

For example, the procedure in the shipyards (and they have accomplished much in their production of ships from keel to launching by their count of a few days and some hours) was to spread over three to ten times the area customarily used. In lieu of building a vessel by adding piece to piece to the keel in the ways, complete ships sections and subassemblies are prefabricated in scattered bays and are then brought to the shipways for incorporation into the vessels. This procedure was similar for the production of planes and tanks, the manufacturing of metals and finished products etc., to the point of preparation of materials, semi-finished items and subassemblies, and the subsequent collection of all this from the several buildings and yards to the central building or area for the final assembling and completion.

Handling Industry During 1942 Does Job Once Thought Fantastic

BY H. M. MILLER
President
American MonoRail Co., Cleveland

■ RAPID conversion of industry to war work in 1942 created many new problems. Industrial research and engineering departments were called upon for better and new designs of war equipment and better and faster means of bringing finished products off the production line. The handling industry was called upon to design and build handling systems for service that but a few years ago would have seemed almost fantastic. Systems were installed for carrying completed 20-ton bombers inside the hangar. Unusual loads in shape and bulk, such as 4-motor bomber hulls and wings, had to be moved safely and quickly on cranes over areas covered by more than 30 miles of runways inside mammoth assembly plants.

Who would believe a year ago that a crane bridge 344 feet long could operate successfully on 17 runways of undetermined length, with cab transfer, covering every foot of floor space in a plant a mile long? Or that a 40,000-pound tank turret casting would move in and out of heat treating furnaces with electrical controls timed in seconds? Today cranes shuttle on transfer cranes to any number of runways. Other cranes equipped with swivelling trucks for movement on turntables at right angles to runways for transfer anywhere inside the building. Another system drops men on platforms around all sides of a completed bomber with spraying equipment for final finish to be accomplished in an hour.

Compulsory Inspection Needed For Cranes During Coming Year

BY F. M. BLUM
Assistant Manager Crane Sales Department
Harnischfeger Corp., Milwaukee

■ THE OVERHEAD traveling crane industry during last year was called upon to do a tremendous job in equipping war plants for handling materials. In order to increase its production without excessive expenditure for plant facilities, it was necessary to strip cranes of all non-essentials leaving off the "cuffs" and the "double-breasted" features and building them as economically and free of all extras as possible. The fact the majority of the crane industry had, prior to the war, changed over to an all-welded design helped materially to increase the production. Even with this increased production the industry was not in a position to meet all the demands. Therefore, many obsolete cranes had to be rebuilt and reworked to meet the users' added needs. As these old cranes are not equipped

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War Accelerates...Technical Progress

MATERIALS HANDLING

with all the safety features embodied in a modern crane, they will require more attention to keep them in good operating condition.

In 1943 the crane industry will be asked to keep these cranes in operating condition by supplying spare parts and engineering recommendations for modernization. Many of these old cranes can be equipped with new trolleys, cabs or controls to allow them to stand up under the service they are required to meet during the war. Modernization of these old cranes will relieve men, now needed to maintain these cranes, for other more vital productive work. Use of obsolete cranes during this war period, has brought out the need for legislation to limit useful crane life and to force compulsory periodical inspection of overhead traveling cranes.

Use of Steel Strapping Protects, Consolidates and Speeds Shipping

BY J. G. BUCUSS
Steelstrapping Division
Acme Steel Co., Chicago

■ AFTER production problems are solved, there remains the important task of protecting in transit thousands of new war time products ranging from field rations to fighter planes. Shipments arriving in a damaged condition at bases overseas may mean the difference between "too little—too late" and victory! Precious production hours and vital materials are totally wasted unless the package has been properly constructed and adequately reinforced.

The value of flat steel strapping as a medium of saving materials, reducing tare weight, increasing carloading capacity and safely delivering the goods is more evident than ever before. Some heavy products which would ordinarily be crated are now strapped to a single piece of lumber with the result that time and material are conserved without sacrificing proper arrival condition. Other products which were formerly packed in cartons and boxes are now strapped to skids or pallets. Still others are bundled or baled to save shipping space.

When used for bracing carload ladings, flat steel bands effect economies in time and labor in both the loading and unloading operations. Larger loads can be properly stowed in each car—but most important—delivery free from damage! Ladings in pool and stopover cars are easily segregated with flat steel bands, avoiding misunderstanding and loss at the several points of delivery.

Standardization, Efficiency Aid Truck Output; Foreign Sales Seen

BY D. L. DARNELL
Baker Industrial Truck Div.
Baker-Raulang Co., Cleveland

■ IN OTHER years the most interesting news in the power industrial truck industry dealt with new designs widening the application of the product. The industry always was one with many models, tailor-made to fit the purchaser's exact requirements. But last year the trend was reversed—fewer models and those only available in standardized designs. Power industrial trucks provide the inside transportation system for industrial plants, warehouses, freight terminals and—in these war years—for ammunition depots, navy yards, naval supply depots, air fields, quartermaster depots and many similar establishments. Each truck does the work of 10 to 20 men and, with industry hitting a new high, with tremendous volumes of materials to be handled for the armed forces and with a man-power shortage facing the country, the government has put up to truck manufacturers the problem of building enough trucks to keep materials on the move throughout this country and wherever our armed forces go.

To match this stupendous job the industry adopted streamlined specifications. Where there were four, five or six models varying slightly in specifications there is now one standardized model designed to best suit the war needs. This reduction resulted in increased output without any increase in plant or equipment. A further refinement—partially influenced by the War Production Board—consisted of a reduction in the number of these standardized models. With these changes, the industry, last year, built upwards of five times its normal output and did it with the equipment on hand—the increase coming entirely from the application of new and better methods. The largest single problem which the industry faced was getting materials in quickly enough. If that single problem could have been overcome to a greater extent, production might have been increased another 25 per cent.

The future trend is doubtless toward a wider use of power equipment for moving materials. In times like these when men are not available, power trucks are given new uses and do them so efficiently that hand labor will never again be considered. The Army and Navy are taking many trucks abroad and when other nations see what can be accomplished with these machines another new market will have been opened.

Handling Industry Shares War Responsibility; Ready for More

BY F. E. MOORE
President
Mathews Conveyer Co., Ellwood City, Pa.

■ NINETEEN-FORTY TWO saw many new developments in conveying equipment. These were bound to come for there were many new materials to be handled, and it was up to the conveyer engineer to find ways to handle them.

There were shell, bombs, cartridge cases, armor plate, and thousands of other materials vital to our war effort, which were being produced in ever increasing quantities. American industry met the challenge, and the conveyer people held up their share of the responsibility. Never before has so much material moved so rapidly over intra-plant transportation systems.

As to what next year will bring, it is difficult to predict because of the many uncertainties involved. Probably the most serious among these is the shortage of essential materials going into conveying equipment. If this shortage is alleviated, we will undoubtedly see even greater strides made in materials handling during the new year. If, however, steel, steel balls, electrical equipment, belting, and other materials critical at the present time should remain so, our problem will be difficult. Wood already is being used in place of steel, wherever possible. Friction bearings are being used to help out in the desperate shortage of balls. Undoubtedly many other substitutions

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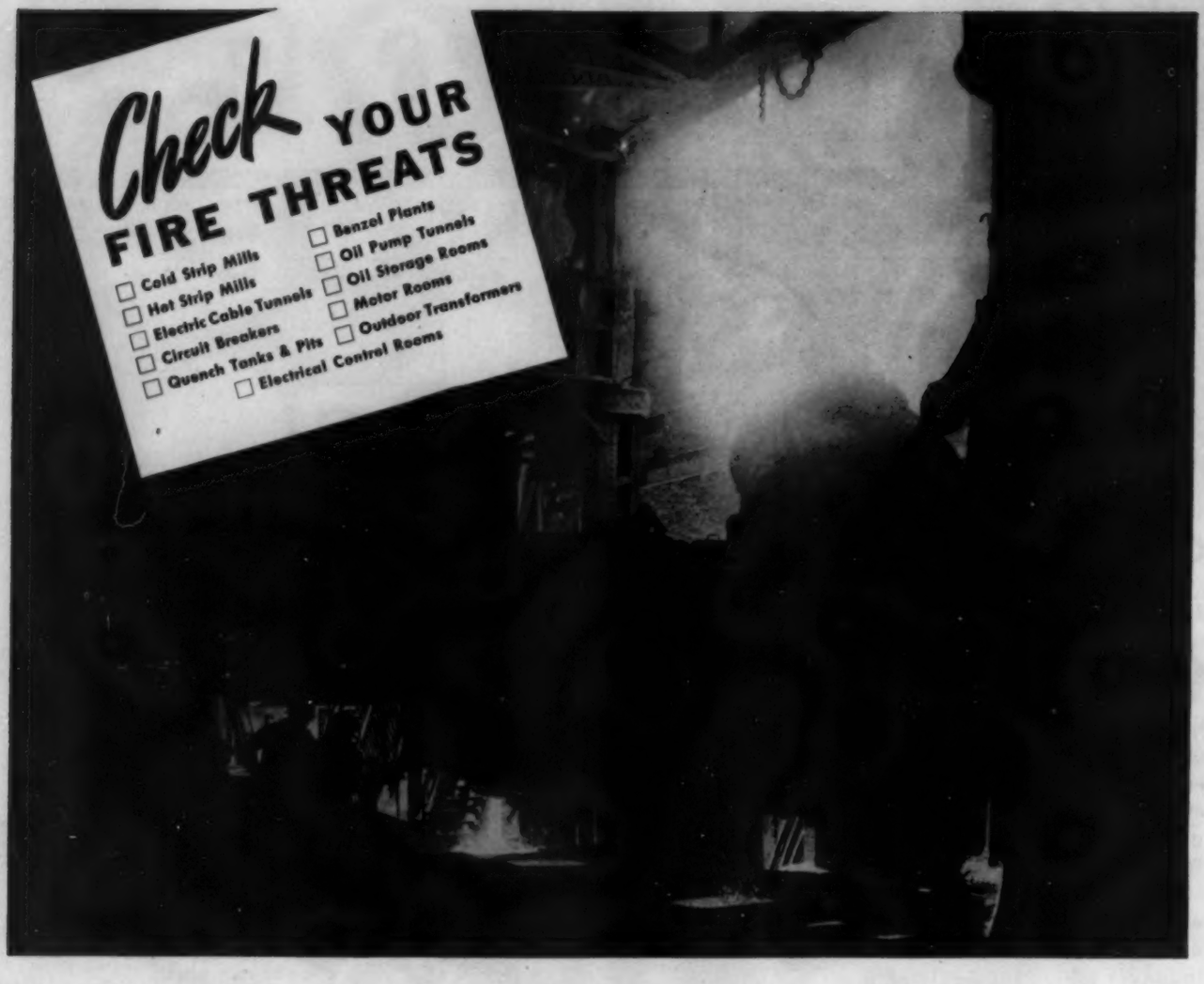

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will appear.

One thing is certain. Whatever happens, American industry will continue to increase the production of war material, and the conveyer manufacturer will continue to do his share toward moving that material. We've got a war to win, and we're all in it together.

Many Developments of Importance Occur in Aircraft Fastenings

BY GEORGE A. TINNERMAN
Vice President
Tinnerman Products, Inc., Cleveland

■ DURING A recent visit to the West Coast, it was possible to review the tremendous advances in fastening systems throughout the aircraft industry. For a period of over two and one half years, development work has been under way that now has resulted in adapting the Speed nut system to meet all of the requirements for nonstructural attachments in military airplanes. Various types of self-locking nuts now used throughout both primary structures and nonstructural attachments on military aircraft are made from bar steel which at present is not too readily available. Now that Speed nuts have received the approval of both the Army Air Forces and the Bureau of Aeronautics for strictly nonstructural attachments, it has been possible to release this bottleneck on self-locking nuts since Speed nuts are made from coiled strip stock, which is more readily available. Too, Speed nuts require less steel.

Many of the largest aircraft manufacturers throughout the United States are rapidly converting all nonstructural attachments to the use of Speed nuts, thereby making more of the heavier type self-locking nuts (made from critical types of steel) available for the primary structural attachments of their airplanes. It is with great satisfaction that we view our successful efforts to convert our entire development and production work to war production in such manner as to conserve much steel and expedite production of military aircraft.

Fast-Quenching Oils Let Carbon Steels Bolts Replace Alloy Steels

BY THEODORE F. SMITH
President
Oliver Iron & Steel Corp., Pittsburgh, Pa.

■ ELIMINATION of certain critical alloys has now reached products which were heretofore in an exempt category. This has gone as far as affecting items as important as armor piercing shot. Because of this, heat treatment of low alloy and carbon steels has come into its own. Even in such items as bolts and nuts, precious alloys are being saved as contribution toward victory.

For instance, wheel mounting bolts for four and six-wheel drive and half-track vehicles were previously made of alloy steel. Today heat-treated carbon steel bolts do this job efficiently. These wheel bolts have to withstand unpredictable abuse, and since their size is limited, high physical strengths are necessary. With quenching temperatures closely controlled and with new fast-quenching oils, bolts can be hardened and drawn at low temperatures with resulting high tensile strengths and good ductility. There are no magic words, for heating must be accurate and uniform. Grain growth must be pre-

Official U. S. Navy Photo

vented by uniform heating to correct temperatures. Likewise, decarburization must be avoided by a controlled atmosphere if fast uniform quenching is to be obtained. Our industry has had excellent assistance in the development of fast-quenching oils that create maximum strength from carbon steels which have been properly prepared.

Bolting Principle Eliminates Shear Damage in Fastenings

BY ERNEST SCHAEFER, SR.
Schaefer Permagrip Enterprises
Cleveland

■ FOLLOWING industrial research in the field of "concealed fastening" for attaching metals, fabrics, plywoods, plastics, ceramics, etc., an effective way has been found to eliminate "shear of bolts," and side strain on fastening units such as bolts, rivets, etc. In the first stages of the development, the outer covering material was arranged to be free of strain. The fasteners, being concealed, eliminated the need for drilling or punching holes through the material. Welding, also, was not employed. A sleek, smooth, nondisfigured outer surface resulted.

Later, with the fasteners still concealed, a way was found to stress the outer covering material. By placing it under controlled tension, in the process of assembling, it became possible to utilize the tensile strength of the materials to any desired degree. The smooth exterior finish feature was retained. One instance will serve to illustrate. Ships in a storm at sea have been known to shear a thousand or more rivets. Obviously, the elimination of shear danger is of vital importance. The Permagrip system, as this development is known, affects numerous fields. While still classed with the newer present day progressive industrial advancements, it is expected that the year 1943 will witness its widespread introduction.

Steel Fabricating Construction Rate Up to 400 Per Cent of 1929

BY V. G. IDEN
Secretary
American Institute of Steel Construction, Inc.,
New York

■ LIEUTENANT-General Knudsen has said: "If buildings would win the war, Hitler would be licked now." No better tribute could be paid the structural steel fabricating industry. In the race against time to produce more planes, more tanks, more guns, more shells and more of every kind of modern weapon, more factories were needed first. The industry has carried that program to a successful conclusion. The volume of factory construction during the second quarter of 1942 was larger than the volume for the entire year of 1929.

Naturally, reinforced concrete, engineered lumber, plywood and other materials have found a place in construction under these circumstances, but that did not give the advocates of these other methods the best of the economic argument, as experience is already proving.

The construction industry is now utilizing its ability to fabricate steel to a plan and a specification by applying it to another job—fabricating steel to a multitude of war uses, supplementing regular production lines by making "bits and pieces" to help our arsenals and factories turn out more of everything needed to win the war. That is the job to which the industry is dedicated. This ability to produce to special plan anything made of iron or steel structural shapes and plates already has proved of unique value in the war effort.

Pirating of Materials Causes Serious Production Difficulties

BY R. E. DILLON
President
Lake Erie Engineering Corp., Buffalo, N. Y.

■ THE YEAR 1942 has presented many problems to the manufacturer. Rising production, fixing of prices, increasing costs, shortage of materials and drafting of skilled labor has made the last depression seem like a tea party by comparison. The two most difficult problems today are materials and labor. Some way should be found to prevent pirating of materials such as large castings and forgings. Foundries and forge shops should be allowed to carry through their schedules and not be constantly disrupted by changing requirements and priorities.

More consideration should be given to the individual merits of a skilled worker before drafting him into the service. Workers are required on the home front if the soldiers at the war fronts are to be adequately supplied. Manufacturers are keenly devoted to winning the war and Washington should help them by simplifying their problems rather than making them more difficult by too many rules and regulations.

Thermit Welding Joins Heavy Castings, Speeds Shipbuilding

BY J. H. DEPPELER
Chief Engineer
Metal & Thermit Corp., New York

■ THERMIT welding has been used for many years for the repair of broken steel mill parts. The larger the repair, the more Thermit welding is indicated. Recently, the amounts of Thermit used have been increased enormously by the demands of the Maritime Commission.

Stern frames for the C-2 and C-3 ships, Liberty ships and troop ships have always been made of one-piece castings or two or three-piece castings joined with a mechanical scarf. (The older wrought-iron frames which were scarf welded have been discontinued.) These frames carry either streamlined rudders or contra-guide rudders. Stern frame sections are triangular in shape, measuring from 18 to 22 inches across the base and 33 to 36 inches in height. Each frame is made of four castings. Each casting has a propeller boss or a heavy gudgeon at its center. These castings must be perfectly sound and capable of being produced by even the smaller foundries.

Thermit welding is used to weld these four parts together. The work is done under the supervision of the shipyard welding forces and under our general supervision. In many cases, the frames are positioned so they can simply be up-ended into their final position. In other cases they are welded remote from the stern of the ship. Welds of this kind take from 500 to 900 pounds of Thermit each and are being successfully carried out at about 15 of the important shipyards in this country.

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Has "Conservation" of Welding Engineers Restricted Progress?

BY R. B. LINCOLN
Director
National Weld Testing Bureau, Pittsburgh, Pa.

■ WE HAVE naturally and I think properly been very conservative in extending welding to new fields. Many of us who wished to promote welding were glad to "make haste slowly" because in the long run we thought that the best interests of welding would be served by avoiding failures. This could be and sometimes was carried too far.

The present emergency has made it necessary to brush aside objections that are not well taken and select the best method whether it is new or old. In quite a few cases this has resulted in substituting welding for other means of joining metals. At the same time, it is more important than ever to give full consideration to objections that are well founded. We cannot afford failures.

Mechanized Oxyacetylene Welding Handles Light Gages, Aluminum

BY H. V. INSKEEP
Development Engineer
The Linde Air Products Co., New York

■ THE VERSATILITY of the oxyacetylene flame for welding and heating applications is being utilized as never before. The mechanized welding of light-gage materials is being applied to such articles as naval shell cases and incendiary bomb containers. Hand welding is used for the short seams on final assembly. Development work carried on over a considerable period of time proved the feasibility of the mechanized oxyacetylene welding of aluminum. This procedure is being used in the production of aluminum shell cases and auxiliary gas tanks. Bronzewelding or silversoldering is being employed for assembly work on chemical and incendiary bombs, shell nose sealing, and box cover fasteners. Heating is done by hand blowpipes or completely automatic arrangements with special heating-head setups.

Hotspinning is being done on aerial bombs with supplementary oxyacetylene heat applied during the spinning operation, using head specifically designed for this work. The spinning of end closures on primer and burster tubes is accomplished entirely with oxyacetylene flame heat.

Lincoln Foundation Studies Show Welding Makes Enormous Savings

BY A. F. DAVIS
Vice President
The Lincoln Electric Co., Cleveland

■ WELDING is truly making an important contribution by speeding war production. Announcement of results by the James F. Lincoln Arc Welding Foundation in its 1940-42 $200,000 Industrial Progress Award Program are particularly significant. As summed up in a statement by Dr. E. E. Dreese, chairman of the Foundation, from which I quote in part these are as follows:

"Savings in critical materials and in production costs, reported available by arc welding in the award studies

of designers, engineers and others in the $200,000 Industrial Progress Program, assume such proportions as to be of vital national significance.

"The figures, based on representative products and structures, show a possible annual cost saving of $1,825,000,000. This includes 7,000,000 tons of steel valued at $271,000,000 and 153,000,000 man-hours of labor. This $271,000,000 is a conservative figure calculated at base prices of $34 per ton for billets and slabs and $42 for plate.

"One representative study reported that caissons under construction and projected for naval dry docks can be built by arc welding in one-third less time and with a saving of 9000 tons of steel, $3,540,000 in cost. Also it allows armor plating for bomb protection with no more steel tonnage than older construction.

"Another study reported that arc welding of propeller blades, alone, would save the aircraft industry $50,000,000 annually. Conservation estimates, based on the reports, indicate an annual saving of $100,000,000 in the vast machinery-manufacturing industry which is vital to our national security in war time and indispensable to our way of life in times of peace."

Predicts Welding To Make Vast Changes in Steel Construction

BY GEORGE T. HORTON
Chicago Bridge & Iron Co.
Chicago, Ill.

■ IT IS APPALLING to think what welding is likely to do for steel construction once this war is over. Our storage tanks and ships have changed. Soon our bridges and mill buildings will follow. Turning fancy free on housing, it is not hard to foresee great changes in the design of our buildings, even in architecture. I visualize a building constructed entirely of steel plates, insulated against temperature changes by known methods, floors supported by large welded-up buckle plates, columns of hollow tubes, no structural shapes being employed at all. Light and air conditioning will eliminate windows, thus make one big change in appearance.

A corollary to such advances is that most of our building ordinances must be rewritten and our building trades rules and practices revamped. That may slow up the process but the development will come, never the less.

Resistance Welding Applications Increase War Production Output

BY I. C. BROWN
Sales Manager
Thomson-Gibb Electric Welding Co.,
Lynn, Mass.

■ THE VARIETY and magnitude of the contributions electric resistance welding is making to war production have been generally well reported in STEEL throughout the year. Among the specific resistance welding developments worthy of special mention is its widespread application to aircraft fabrication involving, of course, welding metals formerly considered the most difficult. This field has been broadened greatly through the use of energy storage and control units.

Another spectacularly successful application of resistance welding has been for sealing base plates on artillery shells, a development that has stepped up production of ammunition enormously. A third development of broad significance has been the use of resistance welders for tool and equipment conservation, illustrated by the many precision flash welders employed for the welding of high-speed-steel tips to low-carbon shanks in the production of drills, reamers, taps, broaches, cutting tools, etc. This has resulted in important savings of critical alloys.

Too, spot welders, projection welders, seam welders and flash welders of all kinds, like standard lathes, drill presses and millings, are out there on the production front working 24 hours a day helping to create machines and munitions of war. Truly, resistance welding is playing its full part throughout the current emergency.

Welding, Cutting Processes Speed Mass Production of Ships, Tanks

BY G. V. SLOTTMAN
Manager
Applied Engineering Department
Air Reduction Sales Co., New York

■ THE PAST year has seen wide spread application of oxyacetylene flame cutting and electric arc welding. Much of the success of the armament program, particularly in construction of ships and tanks, can be attributed to the availability of welding and cutting equipment and of men versed in these techniques. These processes not only lend themselves admirably to mass production setups but they require such relatively simple equipment that it was possible for the welding supply industry to fill the tremendously accelerated demand in time to be effective in the war effort.

Most significant developments have resulted from the necessity of fitting these processes into mass production. In oxyacetylene flame cutting, these include increased speed and greater cutting accuracy; in electric arc welding, increased attention to distortion prevention by prebending, welding sequence and adequate jigging. Large sections of ships and tanks are now flame cut, jigged and welded into unit assemblies as readily as bicycle frames or coffee pots. This adaptation of welding and cutting processes to mass production of large structures has demanded all the ingenuity, initiative and courage of the welding engineer. Special flame-cutting machines of superior accuracy, cams and work positioning jigs for the cutting tables, elaborate welding jigs and positioners, and an intensive study of the breakdown of the structure into primary and subassemblies that can be most efficiently welded are all important developments. More and more such overall factors as yard layout, material flow and handling facilities must be included in the planning.

Sees Lack of Expert Welding Operators Still a Bottleneck

BY A. P. YOUNG
Associate Professor of Mechanical Engineering
Michigan College of Mining and Technology,
Houghton, Mich.

■ THE OUTSTANDING need from a standpoint of welding in industrial and war effort production seems to be expert and special welding operators. The need forms a bottleneck in certain lines. Industrial training centers and technical schools and colleges, as well as the vocational training department of any school, if fully or even partially equipped, can help this situation by accelerating their efforts in training

War Accelerates...Technical Progress

WELDING

welders. It is not possible to adequately train a workman in the art of welding overnight, for long patient practice is required to develop an expert in welding. Nevertheless, every man and woman who possesses the aptitude to learn or to teach welding should be given the opportunity to develop that skill and use it 100 per cent.

On a production schedule such as industry is now striving to meet, the weak points stand out against a background of success. It seems a shame that small groups or individuals who are not doing 100 per cent or more should spoil the picture. There is no dollar sign in the American flag, but it is apparent that too many cannot see the flag for the sign.

Welding Speeds Up 1200 Per Cent; New and Larger Electrodes Do It

BY C. H. JENNINGS
Research Engineer
Westinghouse Electric & Mfg. Co.,
East Pittsburgh, Pa.

■ ADVANCES in arc welding are continuing to keep the welding industry ahead of the increased requirements placed upon it by the present armament program. Electrode developments in the austenitic stainless, low alloy and alternating current fields have made possible great savings in critical alloys with improved quality welds. In addition, these developments have expanded the use of arc welding on many aircraft and armored vehicle parts with a resultant increased welding speed of 800 to 1200 per cent over other methods.

Larger electrode diameters are becoming common. Electrodes ½-inch in diameter have been used on a limited scale. Alternating-current welding is being used more extensively because of its advantages on high current welding and the availability of improved electrodes such as type AWS E-6011 and alternating-current stabilized modified 18-8 electrodes. Special alternating-current machines have also been developed for extremely low current welding on thin gage alloy tubing and plate. More extensive use is being made of positioning equipment to facilitate flat position welding with large-diameter high-speed type electrodes. Welding speeds have been increased as much as 25 to 20 per cent by this procedure.

Use of Automatic Welding Limited By Engineering Staff Shortages

BY ROBERT E. KINKEAD
Consulting Engineer
3441 Lee Road, Cleveland

■ WHILE THERE has been extended use of automatic welding on shipbuilding and some ordnance work in 1942 the amount of such welding done falls considerably short of expectations. The outstanding cause appears to be inability of engineering forces to cope with the number of changes in design and preparation of the joints in view of the slam bang daily load of getting production with green men and inexperienced supervisors. A shortage of men who know how to apply and operate the automatic processes contributes greatly to this situation.

The early battles with inspectors have largely died out as both inspectors and workmen soon get their rough corners knocked off. The government is getting good welding. Progress is being made towards obtaining welding operators who will use the largest electrode and the most heat the job will stand. The year 1943 will see better production per man in welding in spite of turnover due to military demands. In most cases the backbone of welding organizations has been established. The spirit of the men has improved as supervisory forces have become more competent. Women for bench welding are good and generally acceptable. Women for welding on shipways ought not to be employed. In structural shops and on platens in shipyards it is generally expected that some women will be employed. Such employment is not necessary if due cognizance be taken of the fact that men over 40 can be taught this class of welding.

Cooling Rate Studies To Set Up Optimum Welding Conditions

BY G. F. JENKS
Consulting Engineer
The Taylor Winfield Corp., Warren, O.

■ ORDNANCE structures are built largely of low alloy steels, for there is a definite trend toward the use of steels of 70,000-pound yield strength. Substitution of NE steels for compositions formerly available means fabricators must learn not only how to weld low alloy steels, but also must provide a welding technique which can be used on the different and changing compositions. These requirements accentuate the need for research programs such as that of the Welding Research Committee.

This committee has now published its first progress report on influence of carbon and manganese when welding steel. Primary object is to give metallurgists as well as welding and structural engineers data upon which to decide specification limits. A more far-reaching research project will provide a method by which the welding engineer may predict the properties of the welded joint and control welding procedure to avoid conditions affecting safety of the weldment. Here rate of cooling of the heat affected zone is the principal variable. Laboratory investigations will indicate the effect of weld geometry and heat input upon the rate of cooling, and the welding engineer will be given a method and data to regulate rate of cooling required for steels of varying hardenability and for different plate thicknesses. It is expected this new weldability study will be published soon. In addition information on weldability of current and new steels by the weld bead hardness test is being made available.

Resistance welding progress is in the same direction. Research has disclosed certain fundamental information on properties of spot welds in low alloy steel and has suggested heat treatment procedures during welding to produce a strong tough weld. This information is being used by equipment manufacturers in developing suitable control mechanisms for this type of welding. These new developments are being used already to spot weld low alloy steel plates up to ½-inch thickness and for spot welding ⅜-inch carbon steel plates. An impact test is proving most sensitive in regulating procedure control. This is far reaching as it brings spot welding into competition with arc welding of heavy plates.

For aircraft steels the trend is toward more weldable low alloy steels and a wider application of flash butt welding methods, which have already been used to fabricate some ordnance products. Increased recognition of laboratory methods of solving problems is significant.

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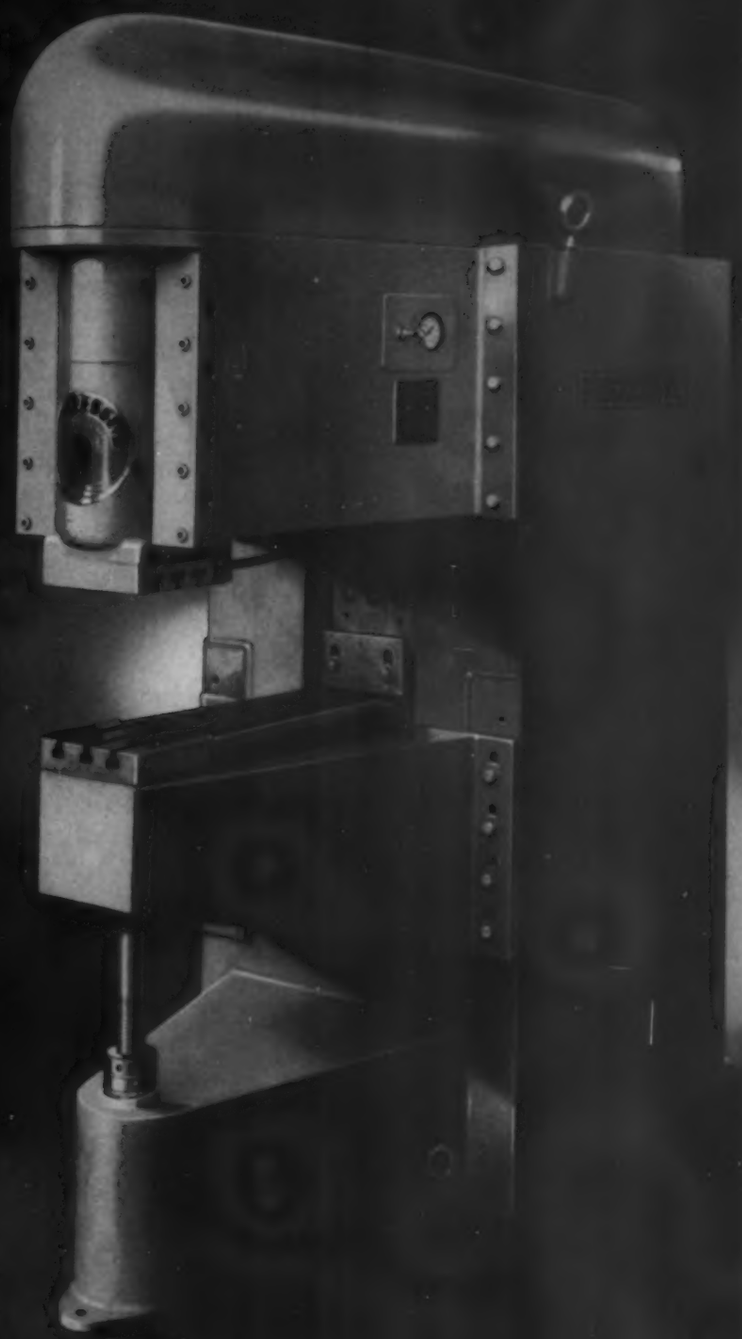

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Resistance Welders Now Handle Heat Treating As Well As Joining

BY R. T. GILLETTE
Works Laboratory
General Electric Co., Schenectady, N. Y.

■ RESISTANCE welding equipment is being built with particular stress on making parts lighter in weight to overcome inertia. This permits quicker follow-up on high-speed, short current-time welding. Various antifriction bearings and special moving parts are also being used to assist in this objective.

Attention is being given to the problem of making equipment more flexible in adjustment for various jobs as well as more sturdy for longer trouble-free operation. The outstanding development under way and one which shows wide-reaching possibilities is the welding and heat treatment in the welding machine of the many types of low and high-alloy steels which are heat treatable. This development opens up an almost unlimited range of welding possibilities. The development of equipment and special heating program controls is keeping pace with the development of welding procedures.

These developments, combined with the new methods of welding aluminum and other nonferrous alloys, are having a definite effect in speeding up the war effort and in making possible many jobs formerly difficult, expensive and slow. Too, these advances will have far-reaching results when industry again returns to peacetime work.

Vertical, Overhead-Position Rod Expands Field for AC Welding

BY F. EDER
Robert W. Hunt Co., Engineers
New York

■ A MOST important problem in connection with war production is how to increase output without causing a commensurate demand for new equipment, prompt deliveries of which cannot be obtained. A notable and successful solution to this problem involves the possibility of greatly expanding the use of alternating-current welding, principally from the development of proper electrodes. Alternating-current welding had been in use for a number of years, but such welding was generally practicable in the flat position only. Electrodes and processes to weld successfully in all positions had, at that time, been developed for welding with direct current, which was, therefore, predominantly employed. This condition had resulted in more extensive development of materials and equipment suitable for welding with direct current than with alternating current.

Difficulties in obtaining prompt deliveries of direct-current welding machines focused attention on the possibility of wider use of alternating-current welding and instigated successful developments in connection with electrodes and processes suitable for alternating current welding in the vertical and overhead positions. It is worthy of note that alternating-current welding machines do not involve rotary equipment and that their delivery can be expected more promptly than that of equivalent direct-current welding machines. Further, welding with alternating current minimizes the occurence and intensity of magnetic arc blow and permits the use of larger electrodes with the possibility of more rapid welding. Upkeep costs for alternating-current welding equipment is generally less than direct-current equipment. Too, power losses when direct-current equipment is running light are greater than the corresponding losses in alternating-welding equipment.

Steels Now Available Clad with Copper, Brass, Cupro-Nickel

BY J. R. HUNTER
Manager Welding Section
Revere Copper and Brass Inc., Rome, N. Y.

■ HEAVY WORK for war items involving fusion welding of medium and heavy gages of copper has now grown to such proportions that today more and more shops are establishing themselves in this field or are preparing to comply with requirements not previously encountered. While the procedures employed vary somewhat, the oxyacetylene method finds widest choice in meeting the exacting requirements. Other methods of joining copper continue to find wide use. Occasional failure of brazed joints due to embrittlement of the adjacent electrolytic copper base metal during execution of the joint is being countered by specifying phosphor deoxidized copper for use with silver brazing as the joining method. Arc welding with Monel electrodes is now employed to join copper to steel after a suitable preheat or overlaying of the copper. This represents a typical method for joining dissimilar metals in maintenance work from which exceptionally reliable results can be expected because of better control over some of the variables.

Copper-clad, brass clad (85 per cent or more copper) and cupro-nickel-clad steels have been recently made available. Welding the latter varies but little from the proven procedures employed in joining Monel-clad steel. It is probable that the numerous methods now employed to weld the cladding metals themselves will also be employed to join the cladding portion of copper and brass-clad steel. Procedure details now worked out assure that the clad vessel will be equivalent, corrosion-wise, to a vessel fabricated entirely of the cladding metal. Phosphor deoxidized copper is employed in the fabrication of copper-clad rather than the copper-silicon alloy.

Welding Speeds Construction of War Plants; 278 Units on One Job

BY ALBERT S. LOW
Vice President and Chief Engineer
The Austin Co., Cleveland

■ WARTIME demands for the more efficient utilization of steel have greatly increased the acceptance of welded construction. Public recognition of the necessity for saving steel at every opportunity has speeded the revision of building codes so welded structures are now authorized in every important industrial center in the United States. Our fabricating shop alone saved over 1100 tons of steel, chiefly plate, in 1942.

Welding has been especially important in the construction of new and greatly expanded facilities for chemical and other raw material and process industries. It has been basic in the achievement of many war production miracles, of which the extraction of magnesium and other chemicals from sea water and salt brines is typical. One project alone called for 278 welding machines to handle structural framing, hundreds of miles of piping, tankage,

electrical equipment and special process machinery which had to be welded on the job. Standard production units required to handle a single stage of the processing at this plant alone took 75,000 man hours of field welding and more than 105 tons of welding rod, 25 per cent of which was copper. The speed attained through welding for such basic industries in 1942 has insured the delivery of vital raw materials which will enable aircraft, munitions and other war plants to attain victory production quotas.

Refrigeration of Electrodes Is Great Aid to Resistance Welding

BY J. A. WEIGER
Vice President
P. R. Mallory & Co., Inc., Indianapolis, Ind.

■ THE YEAR 1942 can be regarded as seeing a number of milestones in the resistance welding industry because during that year a number of contributions were made which should have considerable value, especially in assisting the war effort. These contributions include completion of the publication, "Tentative Standards and Recommended Practices and Procedures for Spot Welding of Aluminum Alloys" prepared by the Aircraft Resistance Welding Standards Committee of the American Welding Society in co-operation with the Resistance Welder Manufacturers Association.

Another important contribution was progress in refrigerated cooling of electrodes for the aircraft industry. Used in actual production for the first time in 1941, resistance welding has found wide acceptance and has produced outstanding results this year. Further refinements will be made as a result of research now being performed. Refrigerated cooling of electrodes will no doubt find application in other resistance welding fields in the near future.

Outstanding progress has also been made by the Aircraft Resistance Welding Research Committee on welding and subsequent heat treatment of high carbon and alloy steels. This work will make possible stronger and lighter weight fabrication of these materials.

Advances in Welding Aluminum Seen Most Significant of Year

BY A. R. ECKBERG
Engineering & Maintenance
Eastman Kodak Co., Rochester, N. Y.

■ POSSIBLY THE most significant advances in welding during 1942 occured in joining aluminum and its alloys. A great increase has been made in resistance and arc welding aluminum. Aluminum castings are being successfully welded to heavy aluminum sheet in Navy equipment that must withstand 300-pound pressures. This work is all being done with the metallic arc. Carbon automatic welding machines are also used in similar applications. In resistance welding, refrigerated tips or water-cooled electrodes with much more effective controls for the current, time of weld and pressure, have proved extremely valuable.

Alloy steel welding has been considerably augmented in the past year due to the tremendous demand for corrosion resistant alloys in all types of powder and chemical plants. Made of stainless steel, such equipment requires the best of welding techniques to obtain the full corrosion resistant qualities of these metals. The largest increase in the use of stainless welding procedure has undoubtedly been in the production of armor plate equipment for the Army Ordnance and Navy Departments. Tanks which chased Rommel across the Libyan sands used all-welded armorplate.

Welding has aided substitution of procurable materials for such items as seamless steel tubing. Such tubing has been replaced by fabricated and welded piping and fittings, since sheet stock can more readily be obtained. We have applied this procedure to copper, cupro-nickel, stainless steel, nickel, monel metal and steel piping installations.

Adequate Welder Training Must Not Bow to Production Demands

BY E. R. FISH
Chief Engineer, Boiler Division
The Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn.

■ THE SAFETY of welded structures must be safeguarded by controlling both welding methods and execution of the work. To this end the American Welding Society, during the past year, has issued several committee reports that are of great value in assuring dependable results of welding operators and the shop inspection of work. One of these reports is entitled "Minimum Requirements for the Inspection of Welding Operators" and another is entitled "Recommended Practices for the Inspection of Welding".

While the demand for welding operators far exceeds the supply, it is just as necessary that dependable welded work be done. To achieve this end, it is necessary that welding operators not only be adequately trained but as rapidly as possible. Incompetent men will not be permitted to work on important structures, even though there may be considerable temptation to risk failure in order to expedite production. A circular recently issued by the director of vocational training for war production workers of the United States Office of Education sets forth the requirements for accredited schools giving vocational training. One requirement is that the provisions of the "American Welding Society Code for the Training of Welding Operators" must be complied with in order to obtain the supplies of welding rods and welding equipment needed to conduct the school activities.

Talkie Color Films Help Speed Training of Welding Operators

BY C. I. MacGUFFIE
Manager Sales, Arc Welding Equipment
General Electric Co., Schenectady, N. Y.

■ TO HELP IN the conservation of time and material in war production, the welding industry is taking a definite responsibility in pointing out to users how they can get the most efficient use out of arc welding equipment and materials. For example, recommendations made to help conserve electrode and speed welding operations include the use of larger diameter electrodes, careful fit-up of joints, close attention to current settings, shorter stub ends and the like.

Alternating-current arc welding equipment offers interesting conservation possibilities since it often permits the use of larger electrodes. Too, alternating-current equipment can be furnished more readily under present

conditions than direct-current type since less machine work and less critical materials such as copper and electric sheet steel are needed. Approximately twice as much welding capacity can be built into transformers as can be built in rotating machines with a given amount of these materials.

To help conserve time and materials in training arc welding operators for war production, G-E sponsored the production and distribution of six full-color talking motion pictures designed to help students learn to become arc welding operators quickly and efficiently. More than 2000 reels are now at work here and abroad.

Expanded Production Capacities Create New Materials Picture

BY E. J. W. RAGSDALE
Chief Engineer
Edward G. Budd Mfg. Co., Philadelphia

■ BEFORE looking into the future, it first is necessary to evaluate the present. The war emergency has inspired new methods and, by the same token, provided money and the occasion for their development. It has also created new capacities for well known materials as well as for some lesser known ones. Material costs will be subject to severe readjustments. That will permit also a readjustment of our choice of materials.

When the Budd Co. first started to develop stainless steel structures, the material cost was almost prohibitive. As the development progressed and the demand for that metal increased, the costs became reasonable, and the productive capacity increased in anticipation of an even greater requirement. This capacity has now stood our government in good stead. In turn, governmental inspired capacities for new and older materials will eventually stand industry in good stead. We have now to look toward future price structures which will obtain when these new capacities and materials become competitive.

Wood Stamping, Forming Dies Deserve More Consideration

BY D. C. VERSON
President
Verson Allsteel Press Co., Chicago

■ IN WORKING sheet metal in aircraft production, wooden dies—reinforced with metal at only the strategic or wearing points of contact—are being used to a greater extent than ever before. In this way invaluable metal, formerly required to make the metal dies, is released for other war work. Wooden dies—properly constructed and intelligently designed—are entitled to more consideration. They can serve well in the present emergency.

Not enough of us know what is being done to conserve what materials are available. In the press industry, probably one of the most interesting developments to date is the one-shot hot forging process. Typical of what is being done is the case of an important aircraft power plant part formerly made from tubing—then bar stock. It was necessary to turn the outside diameter, drill the inside to a relatively thin wall section and drill a hole in the bottom smaller than the inside diameter. Under normal conditions this would have, without a doubt, been an ideal screw-machine job. But, today, with the great need for increased screw-machine capacity, another method of making this part had to be found.

After a short period of experimentation, we found it possible to produce this piece from a small slug. First the slug is brought up to forging heat and placed in a press between dies. When the slide descends, the male die or punch forces this hot slug through the female or lower die to produce a forged semi-extruded tube of almost finished length and dimensions. In successive operations—without again reheating—the piece is pushed through another die and final sized on outside diameter; bottom is sized to a sharp inside radius; bottom hole is pierced and then shaved to complete the piece. Material saved amounts to tens of thousands of pounds; production is high; critical machine tools are released for other jobs; and maximum production is obtained quickly by adapting existing machines—otherwise standing idle—to turn out critical war material with a further saving of material and release of new equipment.

Another important part formerly made from a piece of large diameter tubing is now being hot forged from a flat disk—in one blow of the press—to almost a finished size requiring but a small amount of machining. While material saved is almost negligible in this instance, tubing is scarce and is badly needed for other types of parts which cannot be made from a disk or a slug. Too, manpower is released for other work. There are many more parts that could be thus converted.

Advancements in Steelmaking Practice Aid Ingot Output

BY C. D. KING
Chairman Open-Hearth and Bessemer Committees
United States Steel Corp. of Delaware, Pittsburgh

■ STEEL INGOT production was maintained during 1942 at new record levels. At some plants heretofore operating with fairly high scrap percentages, increased blast furnace output made additional pig iron tonnage available for open hearth use, requiring application of flush slag practice for the first time. In some instances, standard charge ores could not be advantageously used with increasing pig iron percentages, due to the violence of the reactions, resulting in blowing, foaming, and reduced production rates. Some units alleviated this condition by preparing charge ores in the form of briquettes, nodules, or sinter. The use of bessemer blown metal with corresponding lower percentages of pig iron and scrap in the charge, was also practiced at several stationary open-hearth plants with marked improvement in production rates and better balancing of pig iron and scrap supplies. At still other units desiliconizing the hot metal permitted increased pig iron percentages without concurrent increases in ore charges.

The use of improved refractories, more frequent hearth resurfacing, scheduling and shortening the time of rebuilds, scrap preparation, and many other factors contributed to a reduction in operating delays and thereby promoted increased ingot production. Shortages of some critical materials were met by the ingenuity of both open-hearth operators and metallurgists, an outstanding example being the development of "NE" steels. Increased alloy steel requirements involved an increase in the use of big-end-up molds, hot-topping, and mold preparation, and in other cases, bottom-pouring, basket-pouring, and other controls, thereby narrowing the spread between open-hearth and electric furnace types of alloy steels with respect to homogeneity and soundness. Job training programs were intensified during the past year and promise

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THE transmission gear blanks, shown above, are ground on a Blanchard No. 18 Surface Grinder. They are held on the 30″ Blanchard magnetic chuck. The blanks are 3½ inches in diameter and are made of forged alloy steel. .020 inches of stock is removed from each side to limits of .0005″ for parallelism. Blanchard Grinding produces accurate blanks that stack and cut well—and produces them at a rate of 250 (500 surfaces) per hour.

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Official O.W.I. Photo by Palmer

to be an important element in relieving possible future shortage of skilled personnel. New open-hearth plants, recently placed in operation or in the process of construction, incorporate many desirable technical and operating features and should yield new standards for open-hearth production and control. Considerable progress has been made in the wider application of bessemer steels by dephosphorizing either with the aid of liquid slags or by the addition to the steel of cold dephosphorizing materials in the ladle. In addition, improved deoxidation practices have opened up new fields for bessemer killed steels. Some bessemer units are using ore for cooling vessels, displacing scrap or pig iron formerly used, the latter being made available for open-hearth or electric furnace consumption. Electric furnace capacity is being markedly increased to meet present emergency demands for special grades of steel.

Furnace Design and Control Reduce Powdered Fuel Costs

BY P. M. OFFILL
Vice President
The Amsler-Morton Co., Pittsburgh

■ DURING the present period of fuel shortages, particularly in those sections where coke oven gas in not available, increasing attention is being paid to the use of pulverized coal as a substitute for other fuels.

Pulverized coal has been in use for a long period of time and its economies are unquestioned, but equipment has only been available for the last few years that would grind the coal fine enough so that its use would compare favorably with other gaseous fuels and without the troublesome ash deposits.

In our research we have had the advantage of experienced furnace designers as well as engineers with a thorough knowledge of pulverizing coal. This combination has permitted a design that incorporates modern furnace design with a coal pulverizer that puts 85 per cent of the coal through a 200 mesh screen and also the successful use of automatic combustion control.

Investigation of the possibilities of pulverized coal in its application to industrial heating furnaces will be a real effort toward alleviating our shortages of oil and natural gas and in addition will reduce fuel costs considerably.

Operators Adopt 1-Step Method Of Open-Hearth Control

BY M. J. BRADLEY
Market Extension Division
Leeds & Northrup Co., Philadelphia

■ ENGINEERING control in open-hearth shops not only has made possible the remarkable increase in the production of steel during the past year from existing equipment but also the successful operation of the furnaces by operators who have had only limited experience in running an open-hearth furnace.

During the development stages in open-hearth control equipment a few years ago, the usual practice was to install all available controls on one furnace just to try them out. The trying out period consisted of turning off all controls but one, for example, pressure, and running the furnace for a few heats to determine the savings due to the addition of pressure control. Then pressure control would be turned

off and put under manual operation and another automatic control put into operation to determine the savings which could be attributed to that particular control equipment. This method of investigation was continued until all the control equipments were tried out separately. Naturally this method of investigation resulted in confusing figures which could not be duplicated on other furnaces or even on the same furnace. This is due to the fact that the variations in the manually-controlled operations accounted for a far greater effect on the overall operation of the furnace than the one-controlled function.

These investigations supported by fundamental engineering theory and practice have demonstrated that many variables in open-hearth operation can be controlled profitably. At the same time, the method of trying out the controls has changed to a one-step method. For instance, furnace pressure control, instead of being installed with other control on one furnace, is now installed separately on all furnaces in the shop. Then the other controls are added on all furnaces, one control at a time, until a complete system of control is installed. This method has reduced greatly the confusion resulting from changing the operators from a furnace with no controls to a furnace with complete control.

The present change in the open-hearth control status is evident from the fact that the largest open-hearth installation authorized by the Defense Plant Corp., now under construction, specifies roof temperature control, furnace pressure control, combustion control, and automatic reversing for each furnace as a part of the initial installation.

Blooming Mill Now Operates With Amplidyne Control

BY F. MOHLER
Industrial Engineering Department
General Electric Co., Schenectady, N. Y.

■ ONE OF the highly interesting developments of 1942 was the placing in service of the first blooming mill equipped with amplidyne control. This made possible a 50 per cent reduction in the number of control devices. In addition, relays carrying fractions of an ampere were used in place of contactors carrying hundreds of amperes. Accurate control of acceleration and deceleration has made it possible to obtain the maximum rates at all times.

The past year has been unprecendented in the building of arc furnaces for the production of special steels and other metals. A radically new system of control developed uses an amplidyne generator to supply power directly to each electrode motor. Because if its high sensitivity and rapid response, this control provides more accurate, faster, and smoother operation of the electrodes. Contactors and vibrators are no longer needed, thus reducing maintenance.

An outstanding advance in connection with the extensive expansion of electrolytic tinplating is the use of copper oxide rectifiers for supplying low-voltage direct-current power for the plating. These rectifiers have no moving parts except the fans for circulating air. The units are so constructed that the bus-runs between them and the contact rolls can be simplified considerably and shortened. Rectifiers totaling 180,000 amperes are now in various stages of installation and manufacture.

There is now being built a 20,000 kilowatt electronic frequency changer for changing from 44 kilovolt 25-cycle power to 66-kilovolt, 60-cycle, or vice versa. Two units each rated 10,000 kilowatts permit 20,000-kilowatt operation to be obtained. Each unit consists of a transformer and an a-c/d-c rectifier having 12 sealed igniter tubes, and a d-c/a-c converter with a transformer and duplicate tubes.

Use of Boron Bearing Alloys Aids Conservation Program

BY J. H. FLAHERTY
Metallurgist
Jones & Laughlin Steel Corp., Pittsburgh

■ ONE OF the most significant factors in alloy conservation has been the use of boron bearing alloys. Their use in hardening steels apparently has resulted in intensified action of hardening elements in quenching operations. This intensified action has resulted in higher initial hardness and greater sustained penetration of hardness through heavier sections—effects normally achieved only by heavier addition of strategic alloys such as nickel, chromium, manganese, etc.

Boron compounds are added in relatively small amounts (0.05-pound of contained boron per ton) and as the supply is, for practical purpose, unlimited, no problems are involved on account of scarcity of this addition.

Analytical technique for boron in steel is not well established but present methods indicate boron values of 0.0008 to 0.002 per cent in the finished steel, indicating alloy efficiency of 50 to 75 per cent. Values over 0.003 per cent are said to impart hot short tendencies causing surface defects when rolled.

The mechanism by which boron accomplishes its effect on hardenability is still a matter of theoretical speculation. However, an excellent start already has been made in its practical application and undoubtedly still more can be accomplished to help in the conservation of the more strategic alloying elements.

Open-Hearth Operator Faces Many Complex Problems

BY L. F. REINARTZ
Manager Middletown Division
The American Rolling Mill Co.,
Middletown, O.

■ SINCE ALL open-hearth plants in the country are operating at maximum capacity, and new equipment is difficult to purchase, it is not possible to try many new ideas or experiments. The lack of lump ore and the substitution of fine, high silica, high moisture ore in open-hearth charges have presented safety and production problems. As use of high percentages of hot metal increases, problems arising from a lack of sufficient high-grade lump ore, for charging purposes, become very acute. Many experiments are being made in briquetting, nodulizing or sintering fine ore for such charge ore purposes. Briquetting appears to be the best for feed ore, with nodulizing or sintering best for charge ore.

Another problem, which the Conservation Section of the War Production Board has been asked to help solve, is the proper segregation of alloy and common grades of steel scrap in fabrication plants as well as the more thorough sorting and cleaning of dealers' scrap to eliminate metalloids and nonferrous metals, such as lead, babbitt, copper, brass, etc., which are causing havoc in many open-hearth shops. Tonnages of alloy and regular turnings available for use are large. Some way must be found to get them

back into the open-hearth and electric furnace production. Degreasing and bundling or briquetting of light, fluffy turnings is being given careful consideration. If properly bundled, this is the best way to handle turnings.

The fuel situation this winter promises to be serious. Many managements have, in years gone by, eliminated the use of producer gas and have scrapped their gas producing plants. It will, therefore, be necessary to allocate fuel for the use of such plants. A return to producer gas operations will, in most cases, mean a considerable drop in open-hearth production. The personnel problem is acute. Key furnace men and mechanics should be exempted from the selective service. Training of new men is of vital importance, but very few are available. The only other sources for labor requirements are women, whether they will be used extensively in open-hearth operations, as has occurred in England, is questionable.

Use of Silvery Pig Iron Aids Open-Hearth Steel Practice

BY BRADLEY H. BOOTH
Metallurgist
The Jackson Iron & Steel Co., Jackson, O.

■ SILVERY iron contains from 6 to 16 per cent silicon. It is the highest silicon alloy made in the blast furnace. In foundries it is used in mixes containing high percentages of cast scrap or steel; and in the open hearth it is used for deoxidizing the steel, blocking heats, and controlling ferric oxides in the slag.

Among other things it has developed that silvery iron is a necessary constituent in many mixes designed to meet stiff government war specifications. In addition, it has been called upon to supply silicon to numerous plants where foundry iron and ferroalloys can no longer be obtained, at least in sufficient amounts.

To help relieve this shortage of silicon alloys the Jackson Iron & Steel Co. decided early in the year to rebuild and enlarge its blast furnace. Consequently, the old stack was blown out on March 30, 1942 and 12 days later it had been completely razed and work was progressing on the foundation for the new. In another 58 days the new furnace was blown in, and the next day was making pig iron. The total elapsed time was 70 days, an all-time record for speed in blast furnace construction.

Today this new furnace, equipped with Carrier air-conditioning and a sixth hot blast stove, is turning out from 20 to 30 per cent more high-silicon pig iron than was made by old JISCO stack in 1941.

Improving Old Heating Furnaces Facilitates Increased Output

BY FRED S. BLOOM
President
Bloom Engineering Co., Pittsburgh

■ A MAJOR responsibility for increased steel production is shouldered by the combustion engineer. Since a steel plant consists of many furnaces an increase in production must first come from an increase in the speed of melting and heating furnaces.

During 1942 many old furnaces were improved to give as much production as a modern furnace. Sound engineering principles can be applied to old structures as easily as to the new.

Steel plant combustion engineers created, demonstrated, and improved many worth-while ideas which required no radical change in process. Correction of small details in furnace construction can change the quality of furnace operation, as shown by the following examples:—

1. The old regenerative slag and ingot heating furnaces are usually very poor. Concerted effort by one fuel department increased tonnage 50 per cent over previous practice.

2. The majority of steel mill heating furnaces are of the continuous pusher type, of which 10 per cent may compare favorably to a modern furnace. Many have been corrected when repairs were required. Results show 50 to 100 per cent increase in tonnage and 25 to 50 per cent reduction in fuel.

3. Furnace controls are accepted as an essential part of all steel mill furnaces. In degree of importance there are three units; temperature control, fuel-air ratio control, and furnace pressure control. These controls are working parts of the furnace, not just supervisory instruments. It has been definitely demonstrated that 10 to 15 per cent more good material can be produced with control than without it.

New Electrolytic Lines Reduce Tin Consumption One-Third

BY R. H. WRIGHT
Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.

■ ONE OF the outstanding developments of the year is the rapid changeover to the electrical method for producing tin plate. In a number of new electrolytic lines now nearing completion, steel strip will be plated with tin while passing through plating tanks at 500 to 1300 feet per minute. A typical plating line will be supplied with 60,000 amperes at 12 volts, direct current, by means of Rectox rectifiers. The strip leaving plating tanks will have a dull gray matte surface. This surface is brightened and a more uniform distribution of tin coating secured by heating the strip up to the melting point of the tin. This will be done either by passing current through the strip or by passing the strip at full speed through an induction heating coil supplied with energy at radio frequency. By this process the amount of tin used may be reduced to one third of that required for the hot dip process.

Expansion of electric arc furnace capacity required over 400,000 kilovolt amperes of furnace transformers and furnace control. The demand for high-frequency equipment for induction heating continued at an unprecedented rate. Increased use of induction heating will speed up many forging and hardening operations and will reduce the amount of alloys required for parts in which only certain local areas are hardened.

Further expansion of capacity for producing plate is being provided by the installation of large single-stand 4-high reversing mills with unusually powerful drives. One such mill now operating is driven by a 7000 horsepower, 35/70 revolutions per minute reversing motor having the greatest torque of any plate mill motor yet placed in operation. A similar drive is under construction. Another mill under construction will be driven by a 10,000 horsepower twin-motor. This is the first twin-motor purchased in this country for plate mill drive and the highest continuous motor rating to be applied to a single-stand plate mill. Previously the use of such powerful

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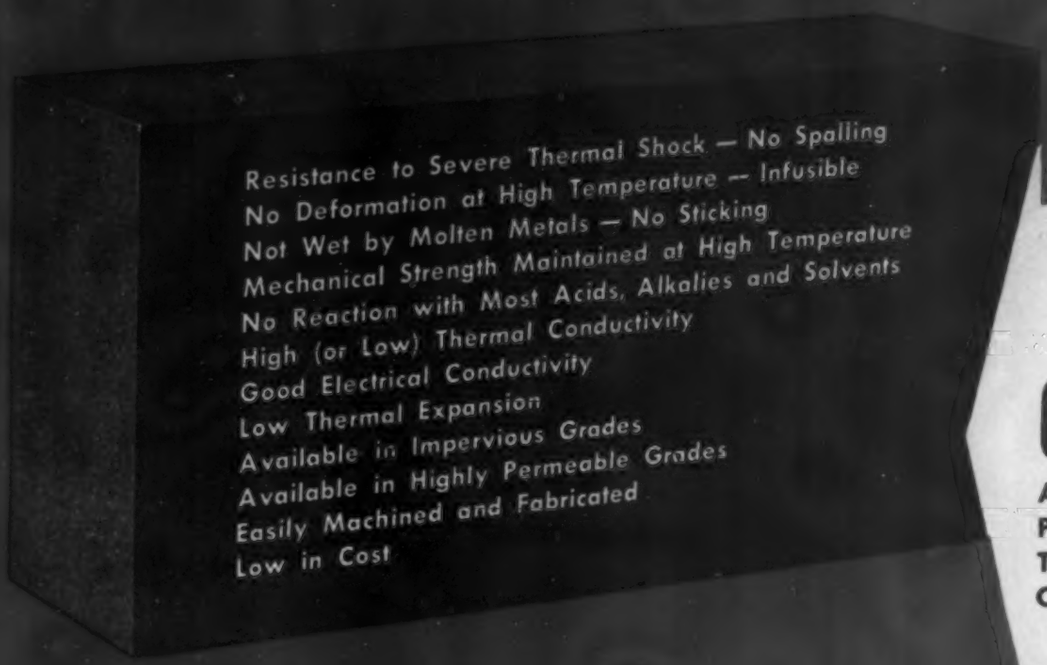

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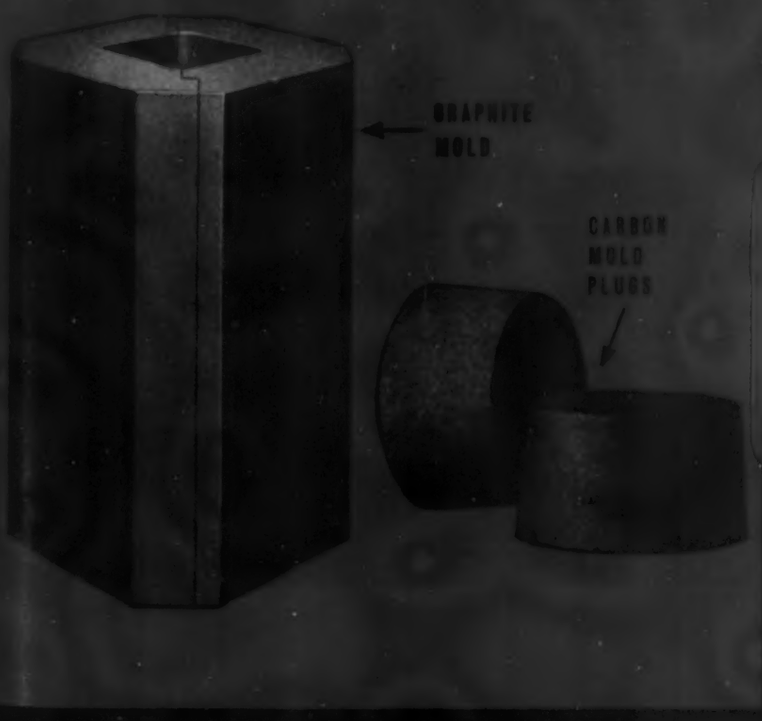

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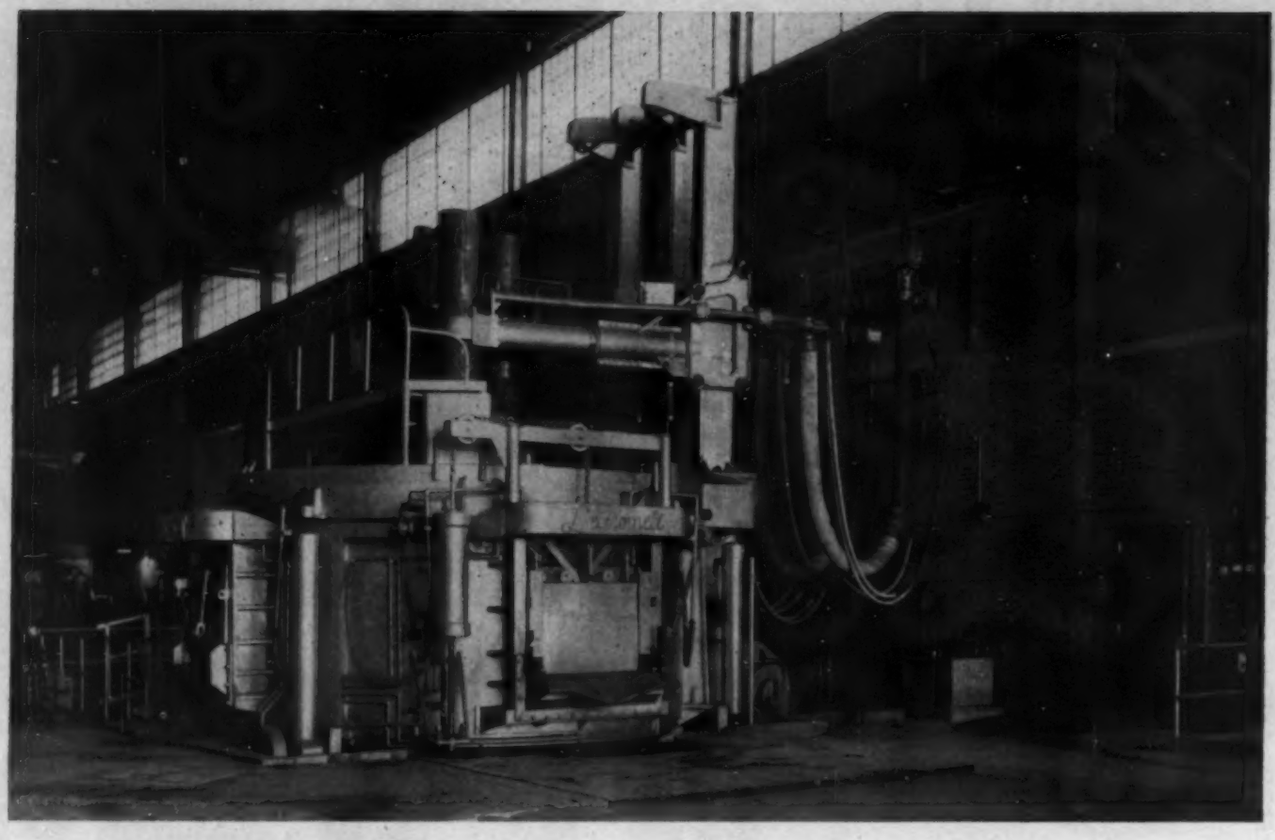

the Furnace of today and tomorrow

The illustration shows, in normal operating position, one of the largest top charge type electric furnaces in the United States. This is a 17′ diameter, size KT, 50 ton capacity Lectromelt, and is now in production on alloy steel. Similar capacity Lectromelts are pouring plain carbon steel. This furnace is of the top charge type, in which the roof is raised hydraulically, and rotated to one side for quick charging with a drop bottom bucket. Both a main working door and an auxiliary side working door are provided for convenience in working a heat.

Top charge type Lectromelts increase steel production. Their use results in lower power consumption, lower electrode and refractory costs and increased tonnage per man hour. Top charge type Lectromelt Furnaces are built in standard sizes ranging from 100 tons down to 250 pounds capacity. Their rugged construction gives maximum production and long life. Write for complete information on Lectromelt Furnaces to meet your melting requirements.

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drives has been confined to large blooming and slabbing mills.

Because of the scarcity of materials, Ignitron rectifiers have largely replaced motor-generators for 250-volt direct-current power supply on new projects. Due to the higher efficiency and reduced maintenance of the Ignitron rectifier this trend probably will continue after the War.

Ore Bedding System Installed At Three American Plants

BY A. J. BOYNTON
310 South Michigan avenue
Chicago

■ ONE OF the features of blast furnace improvements in 1942 was the introduction of the "ore bedding system" previously developed and demonstrated in the American copper industry. In the iron industry the system has been used abroad but not here. Application of the system has this year been initiated at three American plants, each having its own separate ore supply.

The object of the bedding operation is to average the chemical composition and the size of the ore in a bed or pile. The installations in question contain up to 15,000 tons of ore. Stocking is done by dumping from a tripper which works back and forth along the axis of the pile. Reclaiming is done by a traveling conveying machine which removes ore uniformly over the entire cross section of the pile, and works from one end of the pile to the other. Transfer of material is, in general, by belt conveyor.

The system presumes that one bed is being filled while another is being reclaimed. The effect of the bedding is to eliminate with practical completeness variations in size and composition from an entire bed. Where sizing is practiced, the screening operation may be carried on after reclaiming with equally good metallurgical results as before stocking, and the simplicity and cost of plant requires that the operation be done this way, rather than by sizing previous to screening. Both reclaimer and stacker may be transferred so as to serve any number of beds.

The use of the system thus far designed is metallurgical, with incidental storage, which however, is not so low in cost as storage by standard methods. It remains to modify design so as to increase the size of the individual bed. This is the first requisite for application of the bedding system to the large tonnages that must be handled in the steelmaking centers of the country. Such modification is feasible, and the bedding method may become an economical method of storage with metallurgical benefit not now accompanying the stocking operation.

Modern Blast Furnace Output Definitely Set at 1200 Tons

BY RALPH H. SWEETSER
Consultant in Blast Furnace Practice
New York

■ STANDARD tonnage for the 1942 model of iron blast furnace was definitely set at 1200 tons per day, which is an increase of 20 per cent over the standard of 1000 tons per day as established in April, 1930 by the Blast Furnace and Coke Association of the Chicago District. Lines of these big furnaces are so proportioned that the right volume of blast can be blown without undue gas velocities at the stockline and the consequent heavy flue dust loss. The stockline-hearth diameter ratio was too small in 1930.

Several furnaces already have made much more than 1200 tons per day throughout whole months at a time; for instance, the October record of "H" furnace, Lackawanna Works, Bethlehem Steel Co. was 46,246 tons, or 1941 tons per day.

Besides building a properly designed blast furnace that can take wind enough to burn the requisite amount of coke there have been concerted efforts to improve the quality of coke in characteristics other than in simply eliminating excess ash in the coking coal. More attention has been given to increasing the richness of the ore mixture by using more sinter, and especially sintered magnetic concentrates. Mixing of fine limestone with the ore and flue dust fed to the sintering machine has helped to increase the output. Some low coke consumption records have been made—less than 1200 pounds of coke per ton (2000 pounds) of pig iron.

The use of beneficiated air blast has increased this past year. It has been found that the 3 grains of moisture per cubic foot of blast is better, in most cases, than only 1 grain, but even 3 grains may not be the optimum.

Steelmaker Will Employ Water-Cooled Molds

BY EDWARD R. WILLIAMS
President
Vulcan Mold & Iron Co., Latrobe, Pa.

■ COMMENTS were made in the January 5, 1942 Year Book on the increased use of water-cooled ingot molds both for casting individual ingots and for continuous ingot casting. Plans for use of water-cooled molds in the steel industry have been delayed because of the concentration on the manufacture of war materials but in the nonferrous industry the use of water-cooled molds, both for individually cast ingots and continuous ingot casting, has greatly expanded during the year. A large quantity of aluminum, copper, and brass is currently being cast both in individual water-cooled molds and in continuous casting equipment.

Construction of a unit for continuously casting steel ingots by one of the large steel companies is nearing completion, and operations will be started shortly. This unit marks the beginning of continuous casting in the steel industry, and with the probability that many improvements will be made by it in the technique of steel casting, it appears that 1943 will witness the rapidly expanded use of continuous casting in both the steel and nonferrous industries.

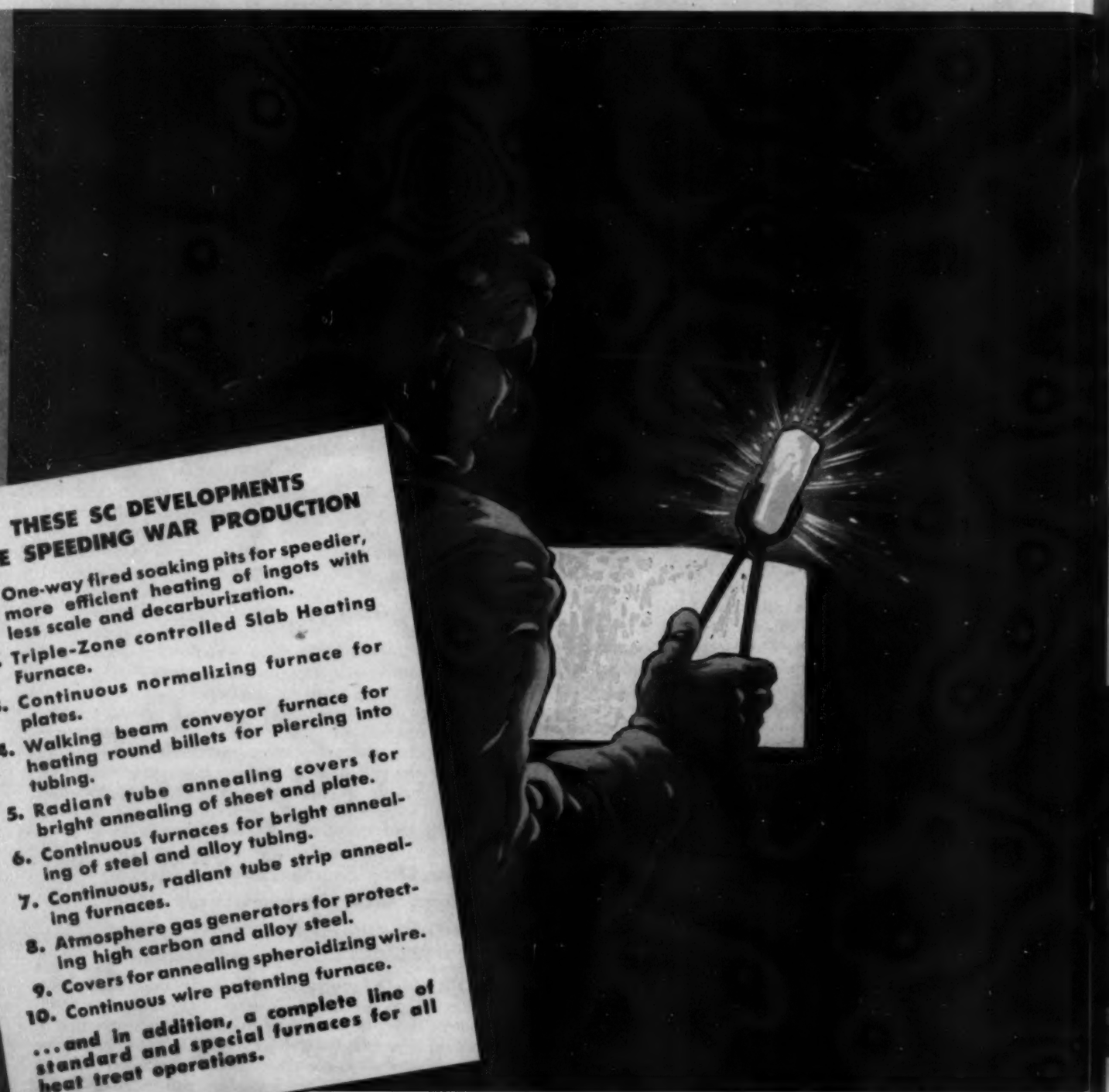
Inferior Scrap Sharpens Skill Of Open-Hearth Operators

BY AN ANONYMOUS STEEL COMPANY
Operating Executive

■ DRY BLAST apparatus placed in operation shows flashes of promise but no average improvement to fulfill pre-installation hopes. Brief experience indicates that if there is improvement it is due more to the uniformity of the blast than to the elimination of moisture. Study of the process and close supervision of and minor improvements to equipment have resulted in new high totals of iron production. Progress is being made in sintering ore.

Results as to both quality and quantity are better than one would have expected in prewar days. Bessemer steel,

A Report



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Veterans of peace-time heating and heat treating, these men have made themselves expert in war practice, too. Their assignment is to see to it that SC Industrial Furnaces are on the job for Victory.

SC Engineering Service goes much farther than that. Long at the forefront in applying heat to industrial problems, Surface Combustion has become a responsible clearing house on the heating and heat treatment of armament. Its great fund of information on war materials manufacture grows steadily larger. Continuing study and research perfect treatment of new metals, advance new treatment for old ones. SC Engineers are called in to help set up new methods. And when new needs arise, SC usually has or can readily furnish the type of equipment it takes.

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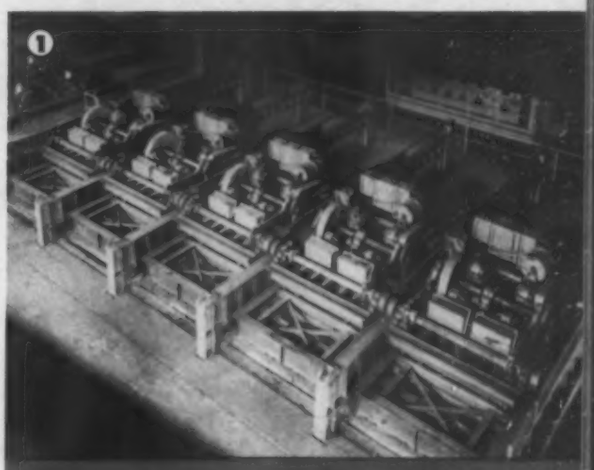

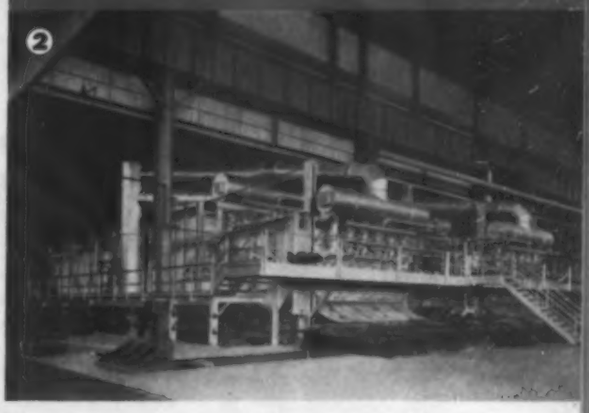

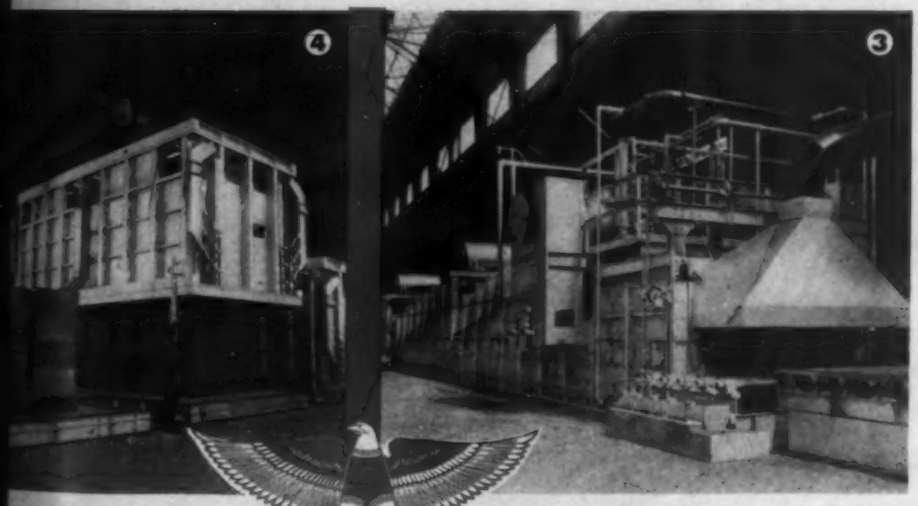

1 INGOT HEATING: SC one-way fired pits help in speeding production of more and better alloy steels for vital war necessities. America's leading steel mills know their efficiency and flexibility to meet modern production demands.

2 SLAB HEATING: SC continuous triple-zone furnaces increase quality and quantity of heated slab for sheet or plate. Complete automatic temperature and combustion control is provided in all zones.

3 SHEET NORMALIZING: In a majority of all continuous strip mills there is an SC continuous furnace for normalizing and blue annealing sheets. Sheets, up to 96" width, are being treated with accurate time-temperature control through zones of sheet travel.

4 COIL AND SHEET ANNEALING COVERS: SC Radiant Tube annealing covers for strip in either coil or sheets are available in a large variety of sizes. Stocks are held within controlled atmospheres. Rate of production has been increased again and again since first development.

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Combustion

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particularly if dephosphorized, has possibilities in range of application not so generally recognized heretofore.

The number of new or war products that seem to be made best by the welding and or deep drawing of flat steel is impressive. With their normal demand curtailed or discontinued strip mills seem to be almost fully occupied.

Common experience during 1942 was that of reducing the use of tin in solder, bearing metals, terne metal, and zinc baths. There has been a rush to find substitutes for tin and zinc coatings through chemical treatments and nonmetallic coatings, but manufacturing practice has not yet been stabilized. Electrotinning is about to displace a large part of the hot-dipped process. The effects of these developments probably will be felt for many years.

Plants are showing evidence of mechanical strain which, coupled with prospect of being called on to continue operating at top speed, is prompting unusual measures to prevent interruptions from breakdowns.

Supervisors have kept quality and production up in face of material shortages that required the utmost in initiative while through it all the manpower problem overshadowed everything. Almost every operator spent his primary energy on such matters as training new employes, dislocation of schedules, seniority, grievances, meetings, etc.

Hydrogen Is Responsible for Many Defects in Steel

BY C. E. SIMS
Battelle Memorial Institute
Columbus, O.

■ HYDROGEN, the gas with metallic properties, has been shown to pervade the whole field of iron and steel metallurgy with its effects. Among these effects is its influence on the porosity or the interdendritic soundness of freezing steel. In heavy-section wrought steel it is responsible for internal fissures known as shatter cracks or flakes, and in sheet it causes blisters. It embrittles steel to lower the mechanical properties. Potent effects are found in pickling, electroplating, hot-dip plating, and in enameling. In fact, it plays so many roles that, in any phenomenon or trouble the cause of which is unknown, hydrogen may be suspect until proven innocent. Unlike oxygen and nitrogen, which have redeeming features, the effects of hydrogen seems to be all bad or useless. A notable exception is the use of hydrogen-embrittled electrolytic iron to make iron powder.

Considerable knowledge already exists but as more is learned of the habits of this ubiquitous and evanescent gas, a cleaner understanding is obtained of the cause and remedy for many troublesome metallurgical defects. The prospect is that most of these troubles can be eliminated.

Combination of Improvements Aids Blast Furnace Output

BY H. W. JOHNSON
Assistant General Superintendent
Inland Steel Co., East Chicago, Ind.

■ IMPORTANCE of the blast furnace in our economic situation has come to the foreground during the past year. With the normal supply of scrap available, there appeared to be adequate blast furnace capacity to meet the pig iron needs of the country. However, as soon as there was a slight deficiency in scrap, it became apparent that more blast furnaces were needed and many new furnaces have been or are being built, both with private capital and at the expense of the government.

While there have been no significant advances in either design or operation of existing or new furnaces there has been an opportunity to combine in these installations all recent improvements and developments. As a result, all such stacks have gone into successful production promptly and all previous records have been broken. The tonnages being produced on these new units are remarkable. Fundamental importance of better processing of raw materials is recognized in all of these installations by providing facilities for screening coke. This program of better preparation of raw materials also is being extended in the building of additional plants for sintering ore fines.

Remarkable strides have been made in decreasing the length of time required for relining and rebuilding furnaces. Tapping salamanders is being done more generally with a resultant saving of ten days to two weeks in relining time. Novel methods of installing brick work, well planned procedures and enthusiasm on the part of workmen have produced phenomenal results in cutting down the inactive period. This has been extended in the rebuilding of furnaces and in one case the novel, but time saving expedient, of building a furnace shell adjacent to an old one that was still in operation was adopted. As soon as the old one was dismantled the new one was moved into position.

The subject of dry blast is still under discussion among blast furnace operators. It is a subject that need be approached with caution, because every installation consumes a certain amount of critical materials. It is apparent that there is considerable variation in results obtained on the installations that have been made. This is to be expected because blast furnaces operate under varying conditions and produce varying grades of iron, and what may be ideal for one may not be for another. What the significant conditions are that determine the success or failure of the application of dry blast to an individual unit, will only be learned after considerable experience.

Minimized Decarburization Calls For Change in Heating Practice

BY M. H. MAWHINNEY
Consultant
Salem, O.

■ CURRENT shortage in machine tools is having an important effect on the manufacture of steel. Because grinders and other tools used to remove imperfections in semifinished steel are difficult to obtain, greater attention has been directed to these imperfections and still greater attention is desirable. Aside from the many physical imperfections of surface, decarburization is responsible for a great deal of this surface removal.

Decarburization has been the subject of laboratory study for a number of years and has resulted in a fairly good background of knowledge of the reactions involved. Spasmodic efforts in applying this knowledge have also been made in the steel industry, but the possibilities that can result from adjustment of heating practices to minimize decarburization have not yet been generally realized.

Two principal sources of decarburization are in the billet heating and in the final annealing of the steel. In billet heating the progress to date has consisted in bet-

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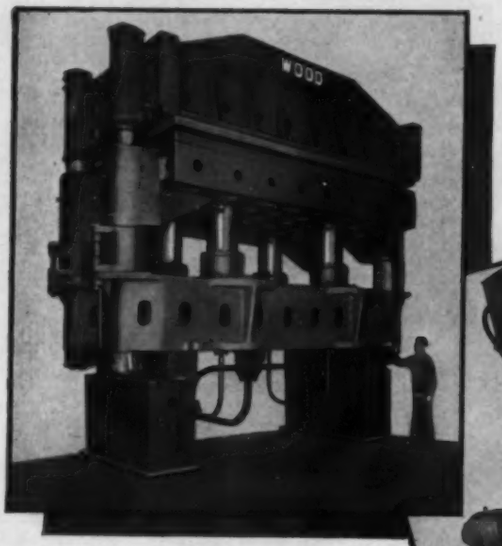
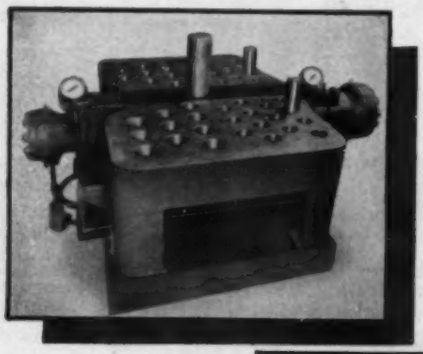


(Above) 800 Ton Wall Board Press with Platen Size of 9'1" x 13'10".



(Above) 125 Ton Carbon Electrode Stub Press.

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ter operation of existing furnaces, including adjustment of atmosphere and pressure in the furnace and control of temperatures and times of exposure. From such efforts it has been determined that the depth of decarburization with proper control of all factors is less than half of that which occurs with careless operation.

In the field of annealing, retort furnaces with protective gas, made in special generating equipment and supplied to the retorts, have been developed in a variety of designs for steel in different forms. The use of such equipment is the only positive way in which to control decarburization during long annealing cycles.

Application of New Coating Processes Conserves Tin

BY R. J. WEAN
President
The Wean Engineering Co., Inc., Warren, O.

■ GENERAL developments in the steel industry this year include bonderizing of black plate to conserve tin. Electrolytic tinning, which was really developed prior to the war but which is coming into general use, uses only about one-third the amount of tin compared with the old hot dip method. Trying to convert an entire industry in a short time, however, naturally raises many problems because of types of finishes required by can companies for various applications.

A question on the lips of many producers is this: Will old style tin plate disappear entirely after the war? There appears to be no definite answer at this time. No doubt that's the trend. Although when the war is over and tin is available at reasonable prices, it will rest with canmakers.

Welded tubing has been accepted by the Navy for boiler tubing, and perhaps will replace seamless tubing to a large extent. Large pipe lines now being built are nearly all of welded tubing.

Other developments in the steel industry are along the lines of war production. Most strip mills have been converted to rolling ship plate and, in some instances, light armor plant. In former years armor plate was straightened by point presses and men would work for hours on some pieces trying to make them reasonably flat. Now various companies are using large roller levelers built on the same principle as the old sheet levelers but huge in size and capacity to get out large production.

Alloy Scrap Segregation Helpful To War Production Program

BY C. H. HERTY, JR.
Bethlehem Steel Co.
Bethlehem, Pa.

■ AS THE WAR production program gains momentum alloy steel production scrap from turnings, borings, and also flashings, clippings and crop ends, is becoming a potential source of alloying elements that is of the first magnitude. There is just one way in which maximum recovery of alloying elements from production scrap can be attained, namely, by segregation at its source.

With very few exceptions it is possible to perform segregation very simply at the plant at which the scrap is produced and with minimum expenditure of man hours. On the other hand, this work now so vital to the defense effort cannot at all be duplicated in many cases by scrap dealers or at steel plants after the scrap is once mixed together. Once it is mixed in no case can segregation be accomplished with as little expenditure of labor. Nor is it likely that as high efficiency can be achieved in alloy reclamation in steel making practice.

A further gain in alloy conservation is possible if light or bulky forms of scrap are given a certain amount of preparation. Crushing scrap such as borings and turnings reduces its bulk and lowers handling costs. Well crushed turnings are readily charged in the open hearth with slight loss of the alloy content from oxidation. Preparation may be carried a step further by briquetting following crushing, further facilitating handling and likewise being advantageous in steelmaking practice. The baling of light-gage cuttings and certain types of turnings is not only similarly desirable but essential.

The indications are that whereas at present about 35 per cent of alloying elements required by the steel industry's alloy steel production program can be derived from scrap, by a more general practice of segregation of alloy production scrap at its source at least 50 per cent of our alloying agents could thus be derived.

Metallurgical and Processing Changes Help Meet War Demands

BY W. B. COLEMAN
President
W. B. Coleman & Co., Philadelphia, Pa.

■ THE YEAR 1942 is unique in the history of metallurgy, for the metallurgists not only had to produce something "just as good" but do it from available materials. Fabrication and heat treatment had to be developed in each particular case. Then with the goal in sight, the changing materials picture necessitated doing it all over again—truly turmoil. But the new steels are here and doing a job.

These developments were far reaching, in most cases necessitating changes in accessory materials. For example, where originally shells did not require an oil quench or perhaps only a slow oil quench, quenching oils had to be improved in order to obtain more rapid quenches to produce the proper physicals in the new steels. Light armor requirements resulted in developing carburizing compounds that produce the proper characteristics in a short time, yet conserve materials . . . . Considerable progress has been made in heating with gas. Special ceramic burners for gas quickly harden armor piercing shot. Speed, minimizing of scale and hardness depths are readily controlled.

Powdered metallurgy has advanced with higher pressures and sintering temperatures. Work has been started on hot and cold working of certain powdered mixtures.

War Effort Focuses Attention on Means To Conserve and Salvage Critical Materials

BY L. A. LANNING
Assistant Plant Manager
New Departure Division
General Motors Corp., Bristol, Conn.

■ TRENDS IN 1942 have moved toward a real attempt at conservation of materials to a degree never before witnessed in this country. A scarcity of raw materials has made imperative a better and more economic use of our available supplies. An outstanding example of this has been the origin and development of a new list of steels, known as the NE series. This series, containing new

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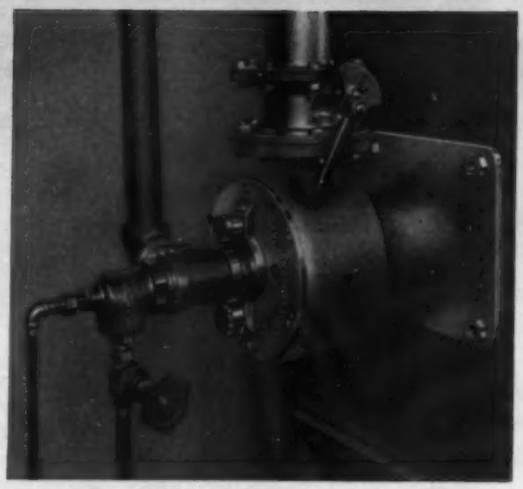

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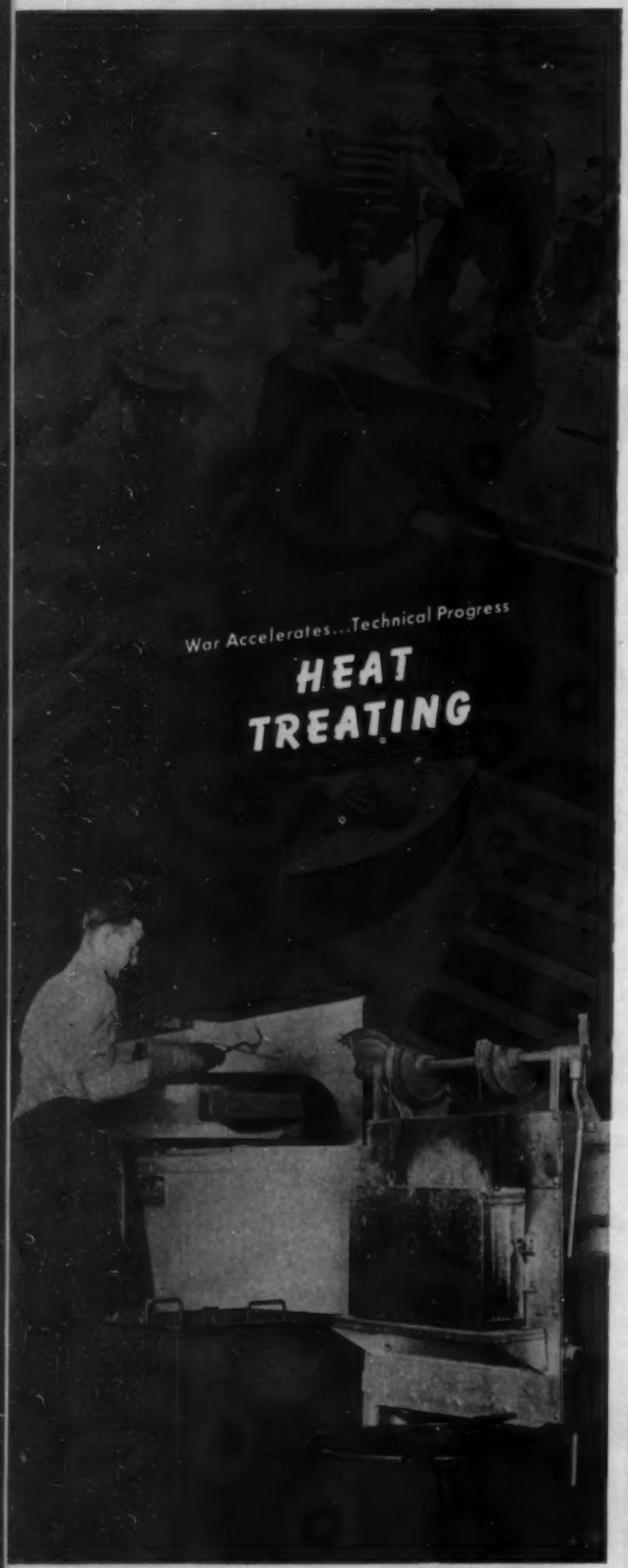

Official U. S. Navy Photo

combinations of alloys in lowered amounts has met with wide and generally successful acceptance in industry. As more information becomes available as regards to the utility of these steels, it is apparent that we need expect no loss in the quality of American products as a result of their usage. It is easy to conceive that they will have an important part in post war industry.

The successful application of salvage methods to lengthen the supply of critical high-speed steel is also extremely important. Without this important alloy steel, the war effort would be greatly handicapped in its expansion. Salvage through the use of such methods as silver soldering, reforging regrinding and tipping have contributed greatly to the thin supply, and these methods will no doubt persist after the war effort. The expansion in the use of carbides as cutting tools has also been an important contribution to the steel cutting industries, and has helped to conserve high-speed steel. Truly, the year 1942 has taught America how to conserve and substitute.

Continuous Rotary-Retort Furnace Units Beat Bad Bullet-Core Bottleneck

BY ELMER C. COOK
Sales Manager
American Gas Furnace Co., Elizabeth, N. J.

■ PRODUCTION of .50-caliber bullet cores was a bad bottleneck early last year. Since then, however, a number of plants have found that by using rotary-retort continuous gas-fired heating machines they have been able to help themselves out of this difficulty. The chief trouble was in obtaining a rockwell hardness which would meet government specifications. With the machines referred to above, more especially those provided with a simple rotary valve seal at the discharge, it has been possible to obtain the required hardness without difficulty.

A simple gas atmosphere, that is, a natural gas atmosphere or a mixed natural and manufactured gas atmosphere or a manufactured gas slightly enriched with propane, provides the retort atmosphere required to prevent scaling and decarburization. It also provides a carburizing action to correct for mill decarburization of the stock. Further, by arranging the discharge so that only comparatively small quantities of work are discharged into the quench at a time, the quenching problem has been greatly simplified. Results are so good that the usual practice now before rockwelling is simply to wipe off the cores with a clean cloth. Readings then obtained are high enough to insure their passing inspection.

Faster Quenching Oils Help in Application of New NE Steels

BY GEORGE W. PRESSELL
Executive Vice-President
E. F. Houghton & Co., Philadelphia, Pa.

■ PRODUCTION of readily machined steels with required hardenability, strength and uniform response to predetermined heat treatment became difficult when alloying elements had to be reduced. In heat treating these steels of lower alloy content, it was soon found necessary to change procedure. To attain necessary physicals with a 1045 steel it became necessary to quench in oil rather than aircool. Thus the quenching medium soon became an important factor. Ordinary oil did not provide the fast rate of quenching required to reduce the temperature rapidly between 1300 and 900 degrees. An oil faster in heat absorption through that

range, and fast throughout the entire quenching range as well, had to be developed. This meant a stable oil that would accomplish faster wetting out and more rapid heat absorption. Study of surface activity which had been going on for years made possible faster wetting. Choice of the basic oil stock and its treatment gave faster heat absorption. Stabilization was made possible by including a patented agent which minimized oxidation or fractional distillation when in service, thus giving the oil longer life and protection against clogging cooling systems—a most important factor.

Precision quenching has received much attention as steel analyses changed. Temperature control of the oil and proper agitation in the tank have been stressed. Faster quenching oils have replaced the severe water quench with its disadvantages of cracking and distortion. Thus modern quenching oils assist in conserving alloying elements by making it possible to use less, yet arrive at comparable results; help many concerns step up war production by solving heat treatment problems.

The past year has proved definitely that there is no problem so difficult that it cannot be solved by co-operative effort between steel maker, users and suppliers.

Long-Cycle Anneals Now Handled Without Any Decarburization

BY E. C. PECK
D-C Generator Engineering
Westinghouse Electric & Mfg. Co.,
East Pittsburgh, Pa.

■ AN IMPORTANT contribution to large savings in man hours of labor and volume of material has resulted from wide application of the heating process known as "bright hardening," a furnace heat treatment of alloy and carbon steels without oxidation or decarburization. A specially prepared gas atmosphere cheaply produced from any commercially available fuel gas surrounds the work in this process. Applications on a large scale production basis include aircraft, munitions and metal processing industries. Its important advantages are: Products are uniformly heat treated without "soft skin" or "scale", allowing quality control on a quantity production basis; the number of machining operations before and after heat treatment can be reduced because tolerances and allowances with this method of heat treatment do not have to be as great as with methods requiring excessive cleaning and grinding; all cleaning operations that require extra labor and result in a waste of material are eliminated.

Another related heat-treating process which might be termed "long cycle nondecarburizing annealing" is also being successfully applied to anneal bar and coil stock where decarburization is to be eliminated. The atmosphere used for this work is relatively inert and consists of a high percentage of dry nitrogen produced from the combustion of fuel gas with subsequent thorough removal of the two decarburizing constituents, carbon dioxide and water vapor. Molybdenum tool steels and steels containing relatively high amounts of molybdenum and manganese (such as those used in bullet core stock) as well as the various alloy carbon steels may be annealed successfully on long heat treatment cycles without decarburization. Elimination of decarburization on large tonnage annealing also results in appreciable savings of labor and material because expensive cleaning and grinding operations during subsequent processing of the material are greatly reduced or entirely eliminated.

War Accelerates...Technical Progress

HEAT TREATING

Controlled Atmospheres Used More Widely In Heat Treating

BY W. A. DARRAH
President
Continental Industrial Engineers, Inc., Chicago

■ FULL EFFECTS of military production have yet to be completely appreciated, changes are still on the way. As a result of the tremendous demand for fuel, while gas and oil have held their own, electric heat appears to have surged ahead in many cases. Its immediate availability and precise control outweighs normal economical considerations. Conventional fuels appear to be approaching their maximum capacity. Such fuels as powdered coal, normally little used for many metallurgical operations, are now being recommended.

Conversion from brass to steel in artillery cartridge cases has brought about much interest in controlled atmosphere operations (bright annealing) as an escape from pickling. Another development is the construction of a large number of industrial furnaces arranged to soften steel and yet quench it from a relatively high temperature in water, yet obtaining a relatively clean anneal.

The industrial furnaces are using progressively less chromium and nickel in the form of heat-resisting alloys. There is a trend to omit the steel housing in furnaces where atmosphere is of secondary importance. The vast extension of the aircraft industry has caused the installation of large numbers of salt bath and circulating atmosphere furnaces for the hardening of aluminum alloys. This work has resulted in further extension of our practical knowledge of atmospheres for use with these alloys. New types of controlled atmospheres are being used commercially with interesting results.

Metallic magnesium has now joined the ranks of the commercial metals although there is still considerable argument among proponents of various processes for its manufacture. It would appear that thermal processes are making headway which may later exclude the high-tem perature direct-current-electrodeposition processes.

NE Steels Already Are Widely Applied in Automotive Field

BY T. A. FRISCHMAN
Chief Metallurgist, Axle Division
Eaton Manufacturing Co., Cleveland

■ CONSERVATION and substitution of critical alloying elements has featured 1942. The acceptance of the NE (national emergency) steels by the majority of users brought about a vast saving of strategic materials such as nickel, chromium, molybdenum and vanadium and facilitated the steelmaking problem considerably. The new steels already have been applied to many uses in the automotive field, including gears, pinions, bearings, steering arms, knuckles, axles, steering parts, pins and many more parts of a similar character. Dynamometer and field tests reported by users have shown encouraging results so far with the leaner alloyed steels.

Bronze formerly used for bushings, pins and washers has

War Accelerates... Technical Progress

HEAT TREATING

been successfully replaced by steel, most generally carburized, hardened and then coated with rust inhibiting compounds which act as excellent break-in coatings. Once properly broken in, seizures with steel are uncommon and service equivalent to that with bronze is obtained.

Another outstanding development has been the widespread application of induction hardening to the manufacture of armor-piercing shot. The rapidity, cleanliness and accuracy of the process is remarkable and peacetime production will see good use of this valuable method of heat treatment.

NE Steel Changes Emphasize Value Of Physical Acceptance Tests

BY ARTHUR E. FOCKE
Diamond Chain and Manufacturing Co.
Indianapolis, Indiana

■ THE APPLICATION of alternate steels continues to be a principal concern. No sooner had we learned something about the steels in the initial NE series than two new types were introduced and we found that we would not be permitted to use one or more of these selected from the first list. So we had to start all over.

Of course such changes are unavoidable and additional ones can be expected. Revisions of types now authorized or even addition of new ones which might include steels treated with "intensifiers" focus attention on developing a new attitude toward steel purchasing and acceptance specifications.

In the past, it has been customary to emphasize chemical analysis and assume that, except for well recognized factors such as austenite grain size and cleanness, if the analysis were correct, the steel could be treated to produce a satisfactory part. Now, except for carbon, the analysis must be kept highly flexible and the emphasis shifted to some physical acceptance test. For the heat treating grades and to a lesser degree for the carburizing steels, the Jominy end quench hardenability test furnishes valuable information for this purpose. However, most of us are not yet willing to use hardenability data alone as a basis for purchase specification and we have had to develop a combination of requirements which include broad chemistry limits and specific descriptions of what we expect the steel to be able to do. Much more can be expected in the line of developing physical property tests to replace chemical range limits formerly specified.

Huge Furnace Equipments Built To Handle War Production Work

BY R. J. COWAN
Consultant
805 Harrison avenue, Lima, O.

■ REQUIREMENTS of war production work upon the heat treating art have been met in every instance by fully developed and standardized equipment. A great variety of atmosphere preparation units have made it possible to employ a particular kind of atmosphere for any special operation, and the conventional types of furnace mechanisms have proven suitable for the exacting requirements. The emphasis placed on quantity production however, has made it necessary to build units of all types much larger in size than formerly. This is especially true of the roller-hearth furnace. Whereas formerly, a furnace 150 feet long was considered to be a good length, now they are made to range in length up to 350 feet—in this latter case for the treating of armor plate.

Pit type furnaces are being built in sizes much larger than usual and there has been a rapid expansion in the use of forced convection furnaces. Continuous gas carburizers are being built in gigantic sizes—without muffles and heated by radiant tubes. A marked improvement in carburizing atmospheres is noted in the development of a cracked gas as a carrier which is of such a character as to permit the carburizing potential of the atmosphere to be controlled by a regulation of the hydrocarbon content of the mixed gases. This atmosphere affects the heat-resisting alloy much less than gases formerly used, thereby extending the life of those important alloy metal units.

Flame Cutting Now Extended to Most Difficult Types of Steels

BY P. E. TIMMERMAN
Development Engineer
The Linde Air Products Co., New York

■ WAR WORK emphasized the unique versatility of the oxyacetylene flame for heat treating. With the need for speed as well as quality, the spread of the oxyacetylene process in the flame treating of ordnance materials has been swift, and the results are gratifying. Materials being flame hardened in increasing quantities include many marine parts, as well as tank and combat-car items. Today an ever-increasing variety of mechanical components are being flame hardened in routine practice. Considerable expansion in the patterned-flame type of hardening has taken place in the last year. This type of flame hardening uses a pattern of many small oxyacetylene flames distributed in such a manner as to heat a desired surface to a required depth without relative movement between flames and workpiece. In this type of hardening, cases up to ¼-inch deep are produced with a treating cycle of approximately 0.5-minute.

Using oxyacetylene flames to soften the hardened zone along the flame-cut edges of certain air-hardening high-carbon or alloy steels has expanded the field of flame cutting to materials previously considered impractical for the method of cutting. Shipyards, ordnance plants, and tank producers and fabricators are flame softening extremely tough material of high impact resistance and similar materials in thicknesses up to 12 or 13 inches, and at speeds somewhat comparable to cutting speeds. The equipment involved is easily portable, which eliminates costly plate handling. And by doing away with the need for large furnaces, floor-space requirements are reduced.

Large Size Gun Barrels Are Heat Treated Continuously by Newly Developed System

BY J. L. WHITTEN
Sales Manager
Lee Wilson Engineering Co., Cleveland

■ THE FIRST continuous heat treating system for large size gun barrels up to 90 millimeters was placed in operation in 90 days after the contract was signed. The unit is electrically heated and consists of a normalizing

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furnace, cooling bay, hardening furnace, quenching system, tempering furnace and final cooling bay, all served by a continuous conveyor system. At present two hundred and forty 75-millimeter guns per day are being heat treated in this unit. Five additional units of this type are being installed in another ordnance plant.

The first unit of an armor plate annealing plant for handling charges up to 500 tons was placed in operation. This furnace is as large as most houses, and its automatic regulation of heat input produces a temperature distribution of 12 degrees Fahr. total spread between 20 thermocouples in the charge. Six more units of this type are rapidly nearing completion. Wilson bell furnaces, fired with vertical radiant tubes, have been adapted in particular to annealing rifle and machine gun clip stock and armor piercing bullet core coils in extraordinarily large charges. Similiar units have been made for rod coil charges.

Many installations have been made of cylindrical bell type furnaces for clip stock and alloy rod coil annealing, for fine wire (0.0095 and 0.0126-inch) annealing for naval cable armoring. New conceptions in the sizes of rectangular bell furnaces have broadened the possibilities of use of this type of unit. Two furnaces of this type were installed for annealing hot rolled and cold drawn straight bars up to 25 feet long, another for tool steel bars up to 31 feet long and still another for seamless pierced tubes of 52100 analysis, 31 feet long.

With a symmetrically designed furnace, gas tight in construction and sealed in oil at the base, gas treatments have been perfected which have resulted in extremely gratifying results in decarburization control. Consistent annealing operations have been obtained with entirely neutral action to the steel surfaces involved, in high-carbon and alloy materials. This has been done with a combination of partial gas combustion and CO_2 stripping.

Automatic Heat-Treating Units Help Increase War Production

BY C. L. IPSEN
Sales Manager
Industrial Heating Division
General Electric Co., Schenectady, N. Y.

■ FORTUNATELY for the war effort, the decade preceding the war saw many developments in specialized furnaces admirably suited to the handling of the vast quantities of war materials now being heat treated. Recent contributions of the furnace industry that have been of tremendous aid to our war effort include equipment for the automatic mass handling of parts through heat-treating furnaces and the protection of such parts from surface change at high temperatures.

A good example of such automatic equipment is the G-E roller-hearth brazing and heat-treating furnace now used for producing millions of important tank parts. After being prepared for brazing and placed on the roll table approach to the furnace, the parts automatically proceed on trays through the brazing, cooling, reheating and quenching chambers. In the quenching chamber the parts are dumped from the trays into the quench tank and thence dropped into tote boxes. The alloy steel parts emerge from the furnace perfectly brazed and heat treated without scale or discoloration. Large numbers of similar roller-hearth furnaces are bright annealing steel cartridge cases between drawing operations in quantities up to 3 tons per hour.

High-carbon steel is now heat treated without decarburization in many types of electric furnaces using atmosphere from which the decarburizing components, H_2O and CO_2, have been removed. A Drycolene producer which passes the products of combustion through incandescent charcoal provides such an atmosphere. A typical application is to a rotary-hearth furnace for heat treating gears and other high-carbon parts without decarburization and without requiring fixture quenching. The Drycolene atmosphere fully protects the high-carbon parts. The rotary table in the furnace enables one operator to charge the parts through one door and remove them from adjacent door, increasing output per man-hour.

Open Gas-Burner Setup Speeds Heat Treating, Cuts Costs

BY FREDERIC O. HESS
President
The Selas Co., Philadelphia, Pa.

■ SELECTIVE high-speed heat treatment with gas in open and semi-enclosed units (in contradistinction to furnaces) has made such striking advances during 1942 that it can be considered a most significant development, and possibly the beginning of a trend throughout the metal industries. This method of heat treatment includes flame annealing as well as flame hardening; which can be subdivided into surface hardening and deep or complete hardening. Operations under this classification are performed rapidly by utilizing specially designed gas-burner equipment that employs refractories for increasing flame temperatures, accelerating combustion rates, concentrating much combustion into small spaces, and producing radiation of high efficiency. Such burner equipment is usually incorporated in automatic machinery.

A number of production installations have been notably successful. These include surface hardening cam shafts, track shoes, armor plate, machine gun parts and others; deep hardening 37, 155 and 75 millimeter armor piercing shot as well as armor plate, push ball rods, track pins and others; flame annealing edges of armor plate, steering knuckles, steel shell cases, copper parts (60 seconds), and others. Combinations of "superheated" and "radiant" combustion of gas and air have provided unusual flexibility and rapidity of heating. The practicability of oil, water or brine quenches with such heating methods has resulted in many interesting and frequently totally unexpected metallurgical results pertaining to grain growth, transition zones and ultimate hardness. These accomplishments, together with low operating cost, promise further rapid expansion of selective heat treating with gas and air combustion.

Manpower Should Be Utilized To Win the War—Not To Meet After-war Conditions

BY W. H. BRETT
Secretary
Enamel Products Co., Cleveland

■ FOR THE past year, little or no attention has been paid to the porcelain enameling industry. The process of converting to the manufacture of a class of ammunition has meant revolutionizing whole setups. It is felt that all manpower should be devoted purely to winning the war. No manpower should be devoted to experimental work to

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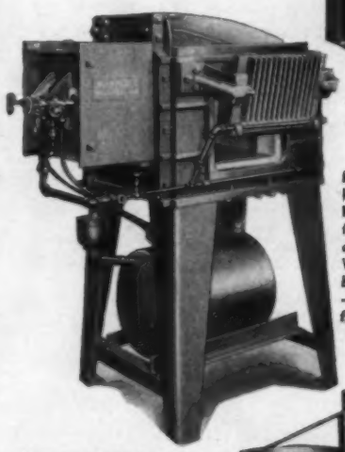

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meet conditions after the war. It is believed that if an organization is maintained and gathers experience in new fields, it will be in a favorable position to tackle whatever economic situation comes along after the war.

War Boosts Demand for Finishing; Materials Scarce; Advances Help

BY C. B. F. YOUNG, Ph. D.
Electrometallurgist
Flushing, Long Island, New York

■ DURING THE past year the finishing of basic metallic materials increased in volume, yet the metals and alloys used for deposits became increasingly scarce. As a result, the government decreed, in many cases, that nickel, cadmium, copper, chromium, etc. should not be used for certain finishes regardless of priority rating. Those in charge, however, have suggested finishes which do not use strategic materials.

For steel coatings there are at least two such finishes, namely, the oxide and phosphate deposits. The first is applied to steel by immersing the object in a concentrated hot alkali solution containing a small amount of oxidizing agents for a short time. The steel takes on a rich black coating consisting of iron oxide. The film is resistant to corrosion and this property is increased if the coating is immersed in oil, soluble oil, lacquer or other similar materials. The second type coating is produced by immersing the steel article in a complex phosphate solution containing metallic ions which act as catalysts. A coating of insoluble iron phosphate is produced which is very resistant to corrosion. Thus protective coatings are produced on steel using only chemical salts which are available in quantity. It should be emphasized that the above processes are not new but have new and broader adaptations. There are other similar applications for metallic bodies which show promise. Molybdate, sulfide and chromate coatings for example are showing possibilities.

War Restrictions Spur Finishing Research; New Coatings Developed

BY G. KLINKENSTEIN
Vice President and Technical Director
Maas & Waldstein Co., Newark, N. J.

■ THE NUMEROUS demands of our war production industries and current drastic restrictions multiplied the research problems that had to be solved by the manufacturers of industrial finishes during the past year. Much of this research work involved improving government specifications in order to meet special requirements of individual industries, to eliminate bottlenecks, and to help speed up production. In addition, an almost complete new line of ornamental and protective coatings in which no critical materials are used had to be developed for low-priority applications.

An acceptable substitute for electroplating was found in a transparent lacquer-enamel, known as Platelustre. This finish, applied to polished metals, simulates brass, copper, bronze, color-treated aluminum and steel, and other metals. Products developed especially to meet wartime demands include: Plydur; a clear or pigmented finish for resin-bonded plywood, used in making airplanes and speed boats. It is extremely resistant to rain, snow, heat, cold and other atmospheric conditions. Durad luminous paint; used to make objects visible during blackouts. It owes its luminosity to a non-radioactive substance that is activated by daylight or ordinary electric illumination.

Glasshield; a transparent coating which gives ordinary glass the ability to resist shattering.

War Increases Use of Phosphate Coatings for Rust Proofing Metals

BY GEORGE H. PIMBLEY
General Superintendent
International Rustproof Corp., Lakewood, O.

■ TREND TOWARD rustproofing iron and steel by means of phosphate coatings, rather than by plating metal, was one of the most interesting developments of 1942. Chromium, nickel, cadmium, zinc—all are critical, and available only to a limited degree. Yet at this time, it is more essential than ever before to protect ferrous metal surfaces against corrosion. Steel is going into all kinds of armaments which are shipped to sharply differing climates, over salt-laden ocean waters. If these are to be delivered and used by our armed forces and allies, they must be adequately rust-proofed.

Phosphate coatings use no critical materials, and are simple to apply. Metals are dipped into the hot phosphate bath for 5 to 30 minutes. This produces a coating of iron and zinc phosphates, deposited into all the pores and crevices of the surface. The film produced is a conversion of the metal itself, consequently does not materially change the metallic dimensions. Phosphate coatings have a porous texture which absorbs and holds paint firmly. It is not, however, a complete finish in itself as it is somewhat susceptible to change by moisture and weak acids. Its place is under good paint, where it affords a good anchorage for the paint, and prevents the spread of rust.

Imaginations in Great Need Now To Cope with Postwar Changes

BY ALFONS BACH
Designer
Stamford, Conn.

■ IMAGINATION is one of the first requirements to a progressive industry. While research has been extended, there is not enough appreciation of the part the industrial designer plays in the projection of our war requirements as well as future products. Under certain circumstances we are forced to expand our imagination. This unusual condition is prevalent now.

Consumer products are subject to complete changeover and may mean an entirely new approach. Little is being done to encourage the thinking of these new methods in terms of future requirements. This is the time to review and proceed with future planning.

Designing is a science and the relationship between engineering and designing is extremely close. No material should be reviewed unless all facts have been ascertained.

War Needs, Use of Ferrous Metals Require Speedy Finishing Methods

BY J. A. PAASCHE
President
Paasche Airbrush Co., Chicago

■ TWO FACTORS—the mass production of products of war and change from noncorrosive metals to those requiring a protective coating has created a great need for automatic and special airpainting equipment. Such equipment not only speeds the finishing operations but also releases men for other important jobs.

For example: The change-over from brass to steel cartridge or shell cases brought on a new finishing problem. Whereas the brass required no finishing, the steel does. A coating of varnish must be applied to the interior and exterior of the latter and baked to form an extremely tough protective film. These cases are now being coated on large automatic machines.

The switch to ferrous metals and the shortage of plating materials, may, according to present day urgencies, affect many products. Organic finishes applied by efficient automatic equipment will provide a solution. Because of the great improvements in finishing materials and the methods of application, many manufacturers will find the necessary change results in lower manufacturing costs and a product improved in appearance and appeal.

1942 Zinc Finishing Advances Confined to Existing Procedures

BY E. A. ANDERSON
Research Division
The New Jersey Zinc Co., Palmerton, Pa.

■ WHILE VERY few new techniques were developed in the zinc finishing field during 1942, important advances were made in the application of existing procedures. Probably the most significant of these came about in the field of conservation of materials.

The use of steel stampings, protected from rusting by electro-deposited zinc coatings, was expanded considerably. While the natural corrosion resistance of zinc suffices for many of these applications, additional protection is required under adverse exposure conditions. This is being provided by a proprietary chromate treatment. Considerable interest developed in the use of high-strength carbon steels protected by painted phosphate-treated, electroplated zinc coatings. There is an increase in interest in the use of rolled zinc stampings and zinc alloy diecastings to replace less available materials.

For military applications, suitable finishes with satisfactory color, luster, and durability were developed for use on zinc. Priming paints pigmented with metallic zinc dust and with zinc chromates are being used considerably both directly on steel and over zinc coatings on steel. A field of particular interest involves these paints in conjunction with heavy sprayed zinc coatings on steel. A development of considerable technical interest was the discovery of procedures for silver plating zinc alloy diecastings over previously applied phosphate films.

End-Use of Wartime Electroplating Removed from That of Peacetime

BY C. W. YERGER
Vice President
Hanson-Van Winkle-Munning Co.,
Matawan, N. J.

■ IN NORMAL times a large percentage of the activities of the electroplating industry is devoted to production of decorative finishes which, incidentally, also improve the resistance of certain metals to corrosion. In war times these activities are completely eliminated, and the only resemblance of war activities

to those in peace time is that certain electrolytic processes are common to both.

The facilities of the electroplating industry equipment manufacturers during war time are devoted to many activities far afield from plating as, for example, low voltage motor-generator sets for "degaussing" equipment for the Navy; multiple-operator welding motor generator sets for direct-current welding for use in Navy yards; anodizing equipment for the treatment of aluminum in aircraft production.

In the wartime application of electroplating the activities are occupied especially with cadmium plating plants for aircraft; hard chromium plating plants for production of heavy ordnance; as well as plants for building up worn gun parts and other similar applications, which are more in the field of electroforming than electroplating. There are also heavy activities in the field of electrolytic tin plants in the steel industry which will conserve a considerable percentage of our supply of tin.

1943 Zinc Production Estimated 1,282,000 Tons; War Needs Rise

BY LT. COMMANDER W. H. SPOWERS, JR.
Bureau of Ships
Navy Department, Washington

■ GALVANIZERS may consider themselves very fortunate that efficient and well-directed allocation of zinc has succeeded in maintaining an adequate supply for all essential uses. Effective measures taken during the early part of 1942 increased our supply from 910,000 tons to an estimated 1943 production of 1,282,000 tons.

However, military requirements for higher grades of zinc increased to such an extent that efforts are being made toward increasing facilities for conversion of Prime Western to the high grades and in view of this a tightening of allocations on Prime Western may be anticipated.

Because of this general trend it will be well if galvanizers look to the technique in vogue in their plants with a view of eliminating any step in the process which may be conducive to waste or the unnecessary consumption of zinc either as a prime metal or as a residuum.

Briefly, there are three major steps in the galvanizing process which should be watched carefully from the standpoint of conservation of zinc: (1) surface oxidation which, in many cases, can be reduced greatly; (2) dross formation, which may, in many instances be cut in half by the elimination of active fluxes; (3) capacity and methods of firing the kettles. Correct furnace design may be responsible for greatly increasing kettle life as well as further reducing dross production.

Use of Oxide Coating Accelerated By War; 1942 Year of Development

BY MARK WEISBERG
President
Alrose Chemical Co., Cranston, R. I.

■ WORLD WAR I saw the introduction and constant expansion of phosphate coatings on ferrous metals to resist rust and increase adhesion of supplemental coatings such as oils, paints and lacquers. World War II is now witnessing the introduction and expansion in the use of oxide coatings. The present tremendous production in small arms for our own armed forces, as well as for Lend-Lease, was helped considerably by this process of producing oxide coatings which give a dull black non-reflecting surface on armaments in 10 to 30 minutes as against the old method of "Browning" which used to take several days to produce. Advances were made in the past year in the production of oxide coatings more resistant to corrosion and abrasion.

As with phosphate coatings, the supplemental coating for oxide finishes is important. Much was done last year in producing oils and wax finishes, some of which will stand as much as 300 hours salt-spray test. The demand for black finishes for other metals resulted in the development of the Oxidine finishes which produce blacks on cast iron, zinc, copper and brass. Oxidine Z, for instance, was developed to produce an adherent black on zinc in 1 to 2 minutes. Substitution of these black finishes for critical metals, which are normally available for plating purposes, are of tremendous value to industry. Other developments of 1942 include alkali immersion copper and cadmium deposits on steel, as well as a combination copper tin immersion bath which is finding important uses and is resulting in a great saving of these critical materials. Bon White, for example, produces, by immersion, a tin coating in 1 to 2 minutes against older method which took 4 to 24 hours. It eliminated, in many instances, hot tinning with a large saving in tin. A deposit of 5 to 50 millionths of an inch is obtained, which is suitable as a pre-tinning for soldering, for lubrication of tight moving surfaces, and the like.

New Ceramic Coating May Lead To Release of Many "Critical" Metals

BY E. HOGENSON
Executive Vice President
Chicago Vitreous Enamel Product Co.
Cicero, Ill.

■ PROBLEM of rust and corrosion resistance for war products of ferrous metals led to the creation of a new type of rust and corrosion-resistant ceramic coating. It is based on an entirely new process, being neither a porcelain or vitreous enamel nor a paint or lacquer or synthetic. It is designed to meet the war requirements in connection with color and low reflectance value.

One point of great importance is that this new ceramic coating, Armor-Vit, is baked or cured at 700-800 degrees Fahr.—about one-half the temperature normally employed for most of the vitreous type ceramic coatings. It should lead to the release of many critical materials such as tin, chromium, cadmium, zinc, some of the critical organics, etc. It also should make possible the conversion of many products to steel, from brass, copper and other critical metals.

Enameling Industry Goes to War; Prepares for Postwar Business

BY R. A. WEAVER
President
Ferro Enamel Corp., Cleveland

■ THE WAR gave the porcelain enameling industry a severe jolt. All in the industry realized in advance that business would be curtailed, but, from experience in England, Canada, and elsewhere, they had no idea that their business would be eliminated. As

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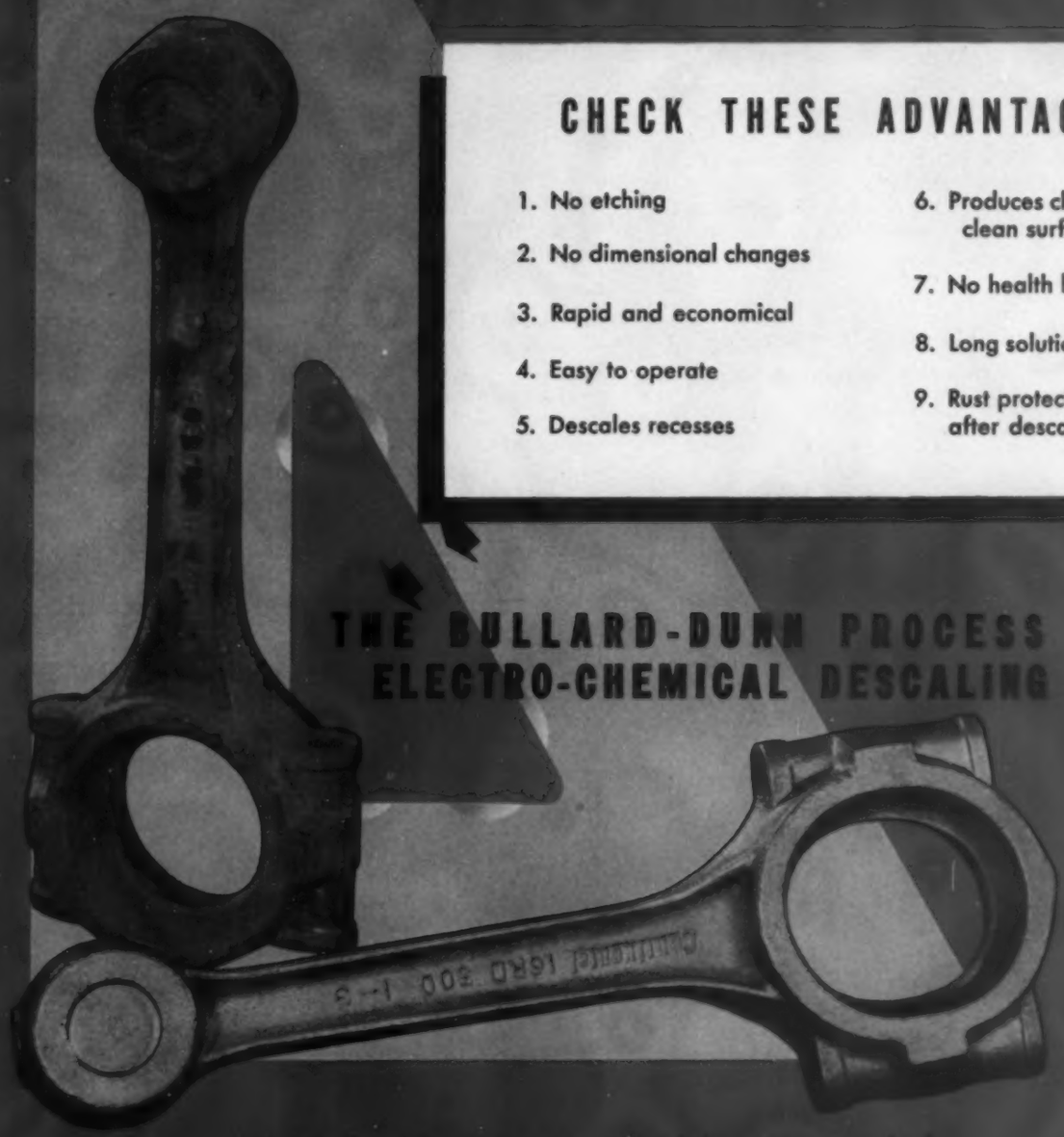

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a matter of fact, last year the industry was quite hopeful that they could substitute porcelain enamel on steel, cast iron, etc., for more strategic materials such as aluminum, stainless steel, and the like, but the industry soon discovered that although it had the porcelain enamel, it couldn't get steel.

The outstanding achievement of the industry during the last year was the conversion of enameling furnaces to heat treating of various sorts. The industry made a real contribution to the war effort and found their experience in handling and controlling high temperatures gave them a big advantage in their new efforts. Practically all the porcelain enameling shops in the country are either closed down or working at a very small percentage of their former volume. Some reflectors are still being made, and some items like coffee urns, steam tables, trays, canteens, airplane exhaust manifolds and stacks are being finished in porcelain enamel, but this meant the substitution of steel for other more critical materials in most cases.

Copper Coatings for Drawing Facilitated by Special Processes

BY F. P. SPRUANCE
Vice President
American Chemical Paint Co., Ambler, Pa.

■ IN THE changeover from brass to steel on small arms and artillery cartridge cases, fuzes and other drawn parts, large quantities of copper will be conserved for other purposes. Problems arising in connection with the drawing and shaping operations are being solved in a satisfactory manner by the use of specially developed products and processes. Copper coatings, so thin as to be of no comparative importance from a conservation standpoint, are being favored as primary drawing lubricants. These coatings can be electro plated, with satisfactory results. Where plating equipment is not available, the coating can be applied by means of processes such as the Cuprodine immersion process. This particular process for example, makes use of a specially prepared copper-salt solution and requires no electric prepared copper-salt solution and requires no current.

Coatings obtained by this method are adherent. They have frequently been found to be even more adherent than electro-deposited coatings. Like all thin copper coatings, their rust resistance is limited although the stability is ample for drawing and forming operations.

Galvanizer's Problem To Stretch Zinc Supply; Improve Practice

BY WALLACE G. IMHOFF
President
The Wallace G. Imhoff Co., Vineland, N. J.

■ THE HOT-DIP galvanizer's most important problem at present is to make what zinc he has go much farther, and to keep down his galvanizing costs. Such operating conditions as pickling losses, coating ratio, bath temperature, submersion time, and galvanizing practice for each article, and group of articles are now being studied with the idea of putting on all of the zinc necessary, but no excess.

Scientific studies reveal very heavy metal losses can result from poor operating conditions, and the wrong bath temperature and submersion time. The trend is to place the pickling and galvanizing practice on a more nearly correct basis for each kind of article galvanized, and also for each class of articles. Scarcity of zinc last year, sharply focussed attention on methods of salvaging this metal from the by-products of hot-dip galvanizing and created an intense interest for improved operation technique that will extend zinc supplies.

Some interesting new developments are the use of glass slabs for pickling tanks, substitution of scrap die casting metal carrying aluminum for an alloy addition to the bath to take the place of aluminum.

Flame-Descaling and Priming Applications on the Increase

BY E. W. DECK
Development Engineer
The Linde Air Products Co., New York

■ FLAME-DESCALING applications in steel mills are on the increase as a result of increased production and the need for faster methods. New applications of these processes are largely limited to war production, consequently details are not available. The processes, used extensively in the production of armor and armored combat vehicles, are now being adapted to gun, shell, and bomb production where previous cleaning methods have proved inadequate.

Tests on heat-treated steels show that neither flame-descaling nor flame-priming for painting affects the heat-treatment of the most sensitive steels. It was shown recently that on flame-descaled surfaces, heat-treatments were more effective because of the increased rate of heat transfer. The improved corrosion resistance of steel surfaces treated by flame-priming was further indicated by exposure tests, during the past year, of large, treated structures and of additional panel tests.

Plating Industry Control Shifts; "Service" Use of Chromium Grows

BY COLIN G. FINK
Head, Division of Electrochemistry
Columbia University, New York

■ IN THE electroplating field the shift in control of the plating industry from the automotive to the steel group was still further precipitated during 1942 by the government's insistance on the application of electrodeposition methods in place of hot dip methods, notably in the case of tin. The saving in tin metal alone over and against that consumed by the older hot dip method will eventually amount to 65 to 70 per cent—with the new tin plate produced presenting better corrosion resistant qualities.

Important too in this shift, as the next few years will show, is the increasing trend of fabricating steel *after* plating instead of *before* plating. This change will have a decided effect on product design and on the zinc die industry. Chromium plating for decorative purposes has practically ceased for the duration. But on the other hand the application of chromium "service" plate to a very wide variety of parts such as bearings, spindles, plungers, crankshafts, rams, pump rods, drills, etc. has increased tremendously. Extension of the useful life of these parts

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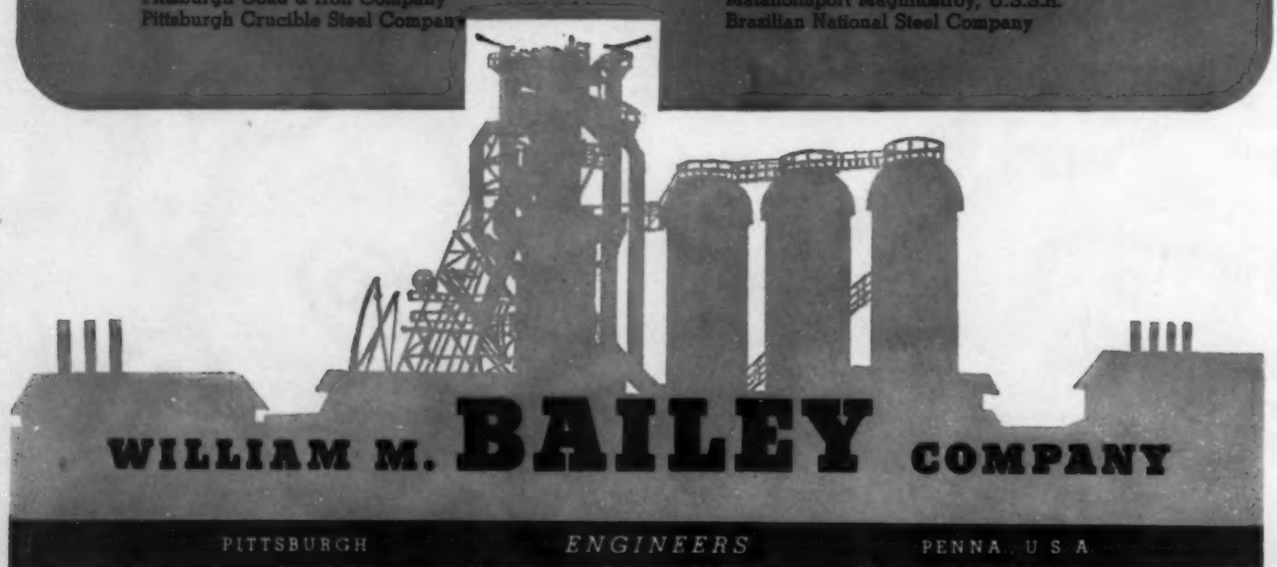

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has through chromium plate been extended a hundred-fold in some cases.

A new decorative, as well as a new "service" plate recently appeared on the market. It is palladium plate from a new practical bath. In apparance it closely resembles platinum or rhodium plate and is likewise highly corrosion resistant. It does not tarnish.

Converted Electroplating Unit Provides Nickel-Plated Wire

BY RICHARD RIMBACH
Consulting Metallurgist
Pittsburgh, Pa.

■ WHILE not a large user of metals, the electric light manufacturing industry does use a number of critical metals, among which is nickel. Solid nickel wire was formerly used in the manufacture of the lamp leads. In most lamps about 1 inch of nickel wire was used. Even with this small amount of nickel and present curtailed production, monthly consumption would, at present, be at least 10,000 pounds.

Some months ago, it was suggested that nickel-coated steel wire would be a satisfactory substitute. The idea was not original but had not been generally used. Two possibilities presented themselves: Nickel-clad wire and nickel-plated wire. Of course the nickel-plated wire represented the greater saving—about nine-tenths of the solid nickel requirement. After extensive testing, it was decided to use nickel-plated wire. Nickel-plated wire is now being produced by several companies. One of these has a number of continuous electroplating units for electrogalvanizing and Corronizing insect screen. By making minor changes one of these was converted and is now capable of plating approximately 30,000 pounds of wire monthly.

Metallizing Aids War Production, Salvages Worn Parts, Saves Metals

BY L. E. KUNKLER
President
Metallizing Co. of America, Chicago

■ ONE OF the most vital processes used for salvage and conservation of materials is that of metallizing. In shipyards, in power plants, steel mills, aircraft factories, foundries, railroad yards—in fact, wherever metal is in use—metallizing guns are keeping production moving. Many applications of metallizing are so closely associated with actual war production that discussion is restricted. Worn metal shafts of any size can be rebuilt quickly to original size by metal spraying. Tests proved repeatedly that a metallized shaft will last from one and a half to three times as long as a shaft not metallized. There are two reasons for this: First, a metal that is harder than the parent metal can be sprayed upon a surface; and second, a metallized surface has a slight porosity which facilitates absorption of the lubricant into the pores of the metal, thus reducing the coefficient of friction.

Mis-machined, pin-holed, and porous castings metallized by foundries are resulting in a tremendous saving in time and materials. Metal patterns, worn by the abrasive action of the sand, are brought back to standard dimensions by the same method. Metal surfaces which are subjected to corrosion are being protected with sprayed zinc.

Copper Plating Steel for Services To Save Many Tons of Copper

BY CARL C. STRUEVER
General Manager
American Nickeloid Co., Peru, Ill.

■ DURING 1942 two new metals were added to the electro-plated metal line, and a war adaptation of important proportions for an older product was developed. The most recent addition was zinc-plated steel, which is now being used successfully in ordnance production as a substitute material for nickel, tin, chromium, aluminum, and stainless. Zinc-plated steel is formed by electro-plating a coating of zinc (of a specified thickness) to a steel base. The finished metal is highly rust and corrosion-resistant and is adapted to such production operations as bending, stamping, forming, drawing, soldering and spot welding. For the present, at least, zinc-plated steel is available only in sheets, in sizes up to 36 x 96 inches with full range of gages and tempers.

The other important development last year was the use of copper-plated steel as a substitute for pure copper or brass in the production of vital ordnance products.

Careful, Efficient Production Enables Red Lead To Meet "Call"

BY GEORGE DIEHLMAN
Research Laboratories
National Lead Co., Brooklyn, N. Y.

■ RED LEAD is meeting the war call. It is being called upon to protect a large part of the unprecedented production of iron and steel which this year is expected to exceed 90,000,000 tons. It provides the durable corrosion resisting paint films that protect our ships, tanks and other iron and steel products. Red lead has established itself as an outstanding corrosion inhibitive pigment. This accounts for the specifications now in effect which call for paint primers pigmented with red lead. In addition there are no limiting restrictions in force at present on the product.

Oil-Retaining Chromium Deposits On Steel Meet Severe Conditions

BY R. O. LOENGARD
Vice President
United Chromium Inc., New York

■ CHROMIUM plating is making possible the saving of a great amount of strategically important metals, not only by increasing the life of the parts chromium plated, but also by salvaging parts worn beyond permissible tolerances, which would otherwise be scrapped. The past year saw a very definite increase in the use of so-called porous or oil-retaining chromium deposits on cast iron and steel, particularly in connection with internal combustion engines. It has been shown the application of a chromium deposit of this type has been extremely beneficial, for instance, on cylinder liners and piston rings, which are subjected to extraordinarily severe service conditions. The application is one of many

NEA Photo

where chromium plating advantageously prolonged the life under stressed conditions of many important machine, engine and equipment parts at a time when the need of such increase in life is very great. The plating of drawing and forming dies, tools, and other equipment used in the manufacture of war *materiel*, also increased substantially.

Atmospheric-Pressure Feeding, Directional Solidification Find Wider Use in Steel Casting

BY W. H. WORRILOW
President
Lebanon Steel Foundry, Lebanon, Pa.

■ A FEW YEARS ago there was developed the principle of atmospheric pressure in feeding steel castings, an entirely new principle applied to the heading and gating of steel castings that resulted in marked savings, for the metal is directed into castings instead of into heads and gates. This principle is being applied to a wide variety of castings ranging all the way from the simplest valve casting to the most intricate tank armor or turbine casting. The percentage of yield of good castings to melt shows a marked increase.

Intensive use of this principle, plus the full and proper use of the principles of directional solidification, mark two of the greatest achievements in steel casting. The refinement and complete use of them has been one of the outstanding achievements at Lebanon this year. A thorough study of these two developments would prove of great value to the industry.

Sees New Light Metals as Stiff Competition for Gray Cast Iron

BY W. L. SEELBACH
Secretary and Treasurer
The Forest City Foundries Co., Cleveland

■ TECHNOLOGICAL advances in the gray iron foundry industry developed in the last few years have been consolidated and strengthened in the year of 1942 due to the necessity of meeting war requirements. The outlook for gray iron castings as such for the post war period does not seem too promising, due to the fact that new lighter metals will be available. Such metals have either had their strength increased or are entirely new developments. These lighter metals will be in much demand for many items that were made in cast iron prior to the war.

However, it is believed there will always be a demand for gray iron castings even though new metals may replace gray iron in many applications. It behooves every gray iron executive to start immediate postwar planning.

Tests Vindicate Converters; Open-Hearth Capacity Upped 30 Per Cent by Duplexing

BY A. W. GREGG
Executive Engineer
Whiting Corp., Harvey, Ill.

■ AN OUTSTANDING achievement of 1942 was the exhaustive series of tests conducted at Battelle Memorial Institute for Whiting Corp., Harvey, Ill., to determine the relative properties of steel castings made by the side-blow converter, open-hearth and electric furnace processes.

These tests showed that the long-standing prejudice against converter steel castings was unjustified and that the quality of steel castings is determined, not by the process, but by the care used in following that process.

This vindication of the converter process has stimulated its use in production not only of steel casting but also alloy ingots and armor plate. There has been an important extension of the triplexing system, in which hot cupola metal is blown in a side-blow converter and then transferred to electric furnaces for alloying and distribution. This allows continuous operation in steel foundries for the first time. A recent installation of this type has four side-blow converters of 6 tons capacity each. An important producer of alloy steel castings has contracted for a duplexing system in which the cupola metal is transferred directly to the electric furnace for refining and finishing. Another foundry producing automotive castings for war use is now duplexing cupola metal in a pulverized-coal-fired cradle furnace that permits "lip" pouring of the finished metal to a continuous conveyor line, achieving exceptionally high output.

During 1942 several large foundries installed equipment for hot blast for their cupolas, thus effecting considerable savings in coke and improving general operation. Interest in equipment for controlling the moisture content of the cupola blast is likewise on the increase. A producer of piston rings for airplane engines reports marked improvement in uniformity and quality of product since installing moisture control apparatus.

In the open-hearth field some important producers have adopted the duplexing system, using desulphurized cupola metal for about 40 per cent of the charge going into the open-hearth furnace, thus increasing open-hearth capacity by 25 to 30 per cent. This is applicable to open-hearth plants having no blast furnaces.

One-Man Control of Substitutions Helps Prevent Shop "Blockades"

BY P. J. POTTER
Executive Vice President
Pangborn Corp., Hagerstown, Md.

■ LIKE ALL other equipment manufacturers, we must make substitutions for scarce materials. Frequently the job is on the assembly floor before we know positively that we are unable to secure a certain steel or part. To avoid the shop blockade that would result, we have taken one of our engineers who knows our line intimately and put him in charge of all substitutions. He has authority to make all required changes. He not only designates and approves materials used or any change in design but is responsible also for changing drawings, specifications and bills of material. This procedure assures quick action when substitutions are necessary. Also it assures correct records of every change.

Some of our cast parts are hard nickel-alloy iron, abrasive resistant, subject to severe wear, and must be replaced frequently. To conserve virgin nickel, we asked all our customers to return the worn parts at the price designated by the OPA when ordering replacements. Our customers have co-operated with us to such an extent that our monthly returns of nickel scrap equal 47 per cent of the metal shipped.

Extensive use is being made of the NE steels. Hot rolled steel is being employed wherever possible in place of cold drawn and cold rolled steel. Designs are constantly being reviewed to conserve materials, and also man hours. Many parts having light loads and formerly made of steel have been changed to cast iron. One part had only a compression load. It was made of 2½-inch square steel bar stock, having machined holes. Now it is made as a casting with the holes cored to size. Another part composed of one casting and three other steel parts was combined into an integral iron casting thus saving steel and expediting production by saving numerous machine operations.

War Increases Demand for Those Products Cast Centrifugally

BY HAROLD J. ROAST
Vice President
Canadian Bronze Co. Ltd., Montreal

■ WITH THE ever increasing demand of the war effort on the bronze foundries and bronze castings come many problems. I am impressed with the increasing need of making castings "honestly good all the way through." This is necessary if we are to leave welding and forging operations free to do other war work that cannot be covered by the casting industry. A great deal of the hesitancy of the engineer to use castings instead of welded or forged structures is due to the internal defects of castings which are caused by lack of proper manufacture as well as proper inspection.

In this connection, I feel there is a growing demand for centrifugally cast products, both those cast in chill molds and those in dry sand molds. Then again, there is an increasing need for castings made in chill molds even without the centrifugal operations—for example, pressure disks that are required to be entirely free from internal intercrystalline shrinkage. Now that tolerances of machined castings are required to within 0.001-inch on diameters as high as 4 inches, we find changes in measurement occurring after machining. This emphasizes the need of heat treatment of bronze castings before machining and in some cases even after rough machining. These three things, centrifugal castings, chill castings and heat treated or annealed castings, are tendencies that will increase as time goes on.

Tin Succeeds Aluminum As Most Critical Nonferrous Material

BY N. K. B. PATCH
Secretary
Lumen Bearing Co., Buffalo

■ THE NONFERROUS foundry industry moves along with 100 per cent war demands and the problem of limited supplies of the necessary raw materials. A year ago, aluminum was short and all nonferrous foundries using that metal regarded this shortage as a possible cause of trouble. But today production has improved so there is not the difficulty in securing the necessary needs of the foundry that was with us a year ago.

Today tin is the metal that is giving many headaches to the nonferrous foundry industry. The recovery of tin from scrap is being carried on much more thoroughly than ever before and the prohibition of its use in anything but war requirements is with us and will be with us as long as the present shortage exists. Consequently, substitution of other materials for tin is being considered by all who have heretofore found tin the easy solution of their problem.

War Accelerates...Technical Progress

CASTING

Tin bronzes are being eliminated by use of other materials, noticeably manganese bronze and aluminum bronze, for such bronzes will give a fair service in many cases. There are, however, some applications where copper-tin bronze is absolutely essential and nothing else has yet been found to take its place. For these purposes, tin is still being made available. Much of this, of course, is in the form of reclaimed bronzes through the refining of scrap bearings, valves and other tin-bearing bronze castings.

Armor Steel Castings Successful Even with Alloys Much Reduced

BY JOHN HOWE HALL
Metallurgist
General Steel Castings Corp., Eddystone, Pa.

■ AN OUTSTANDING accomplishment of the steel foundry industry during the past year has been in the field products which demand exceptionally high strength, ductility and toughness. Plants with up-to-date equipment and competent technical staffs have in the past been able to make castings suitable for exceptionally severe service by employing various alloy steels, suitably heat treated.

With the growing scarcity of steel-making alloys which resulted in the development of the various NE steels, it has been necessary to reduce the quantity of some alloying elements and eliminate others. At the same time, no sacrifices can be tolerated in the high quality demanded by service conditions. By careful attention to all details of steel making, molding, pouring practice and heat treatment, it has been possible to attain the high level of quality formerly secured by more liberal use of alloys, yet using combinations and percentages of alloys that a year ago no one would have supposed could possibly have given steel of satisfactory properties.

Bronze Foundries Learn Better Control Practices from War Work

BY C. J. ZAISER
President
Ampco Metal, Inc., Milwaukee, Wis.

■ WORLD WAR II, notwithstanding its unparalleled destructiveness, has nevertheless served to build and educate many American industries. The bronze alloy industry is one of those whose modus operandi has been strongly affected. Most bronze foundries are small, local in coverage and ill-equipped from a standpoint of control and research facilities. Only a few are fortunate enough to have adequate control and research facilities and to operate on a national scale. All bronze foundries, however, by virtue of the war program have been forcibly educated in control and in the meeting of specifications through work done for Ordnance, Navy and other federal agencies. But experience cannot react other than favorably to the industry in the years of peace to come.

A factor adversely affecting the bronze casting industry and which has developed largely during 1942 is the increasingly critical shortage of copper, tin and some other alloying elements. To counteract this shortage, various federal specifications for bronze have been modified to permit of higher impurity content, and various alternate materials have been advanced as acceptable for substitution. Such concessions as these cannot help, but adversely affect the quality of the output of the average bronze foundry, particularly those lacking the control measures mentioned above. Users of bronze castings should, and for the most part do, recognize this fact and make allowance therefor. It is to be hoped that the steps which are being taken to relieve these critical shortages will prove effective early in 1943.

Foundry Problem: Make First Class Castings from Scrap Materials

BY CHAS. HOEHN
President
Enterprise Engine & Foundry Co.,
San Francisco

■ SHOP PRACTICE in our foundries is following, to a great extent, the same pattern in World War II as it did in Word War I. We are obliged to make first class castings using practically 100 per cent scrap materials. The secret of success under these conditions lies in the closest kind of attention to the minutest details. Shop practice must be altered to suit the materials available. Each design of casting is a separate study in itself. Old man experience, coupled with the latest scientific developments in materials and methods, is the surest way to achieve maximum production for this all-out war effort.

It is the policy of this company to encourage its foundry employes to take membership in the American Foundrymen's Association in order that they may have access to the latest developments in the foundry industry and thereby be in a position to understand personally what it is all about. A better job is sure to result.

WPB Could Do Real Service in Supplying Information on Secondary Aluminum

BY SAM TOUR
Vice President
Lucius Pitkin, Inc., New York

■ EARLY IN 1941 it became evident that so-called secondary aluminum must be used in the war effort to supplement the production of new aluminum. The logical place to use secondary metal was in castings for military equipment. But a survey of government specifications showed such stringent impurity limits that such use was impossible. It was necessary to start a campaign to revise old specifications or issue new ones for aluminum castings and to find out what alloys could be made from the secondary aluminum. Little progress was made in 1941 along either of these lines. Considerable progress has been made in 1942. More progress is possible and 1943 should show further advances.

New permanent and emergency specifications have been adopted by services. Those of the Army Ordnance Department and some of the Navy Department are clearly a step in the right direction. Certain Navy Department revisions and most Air Service revisions give only lip service to actual needs. There the slight adjustments in certain impurity limits are pure camouflage to cover resistance to use of secondary metal and in effect do not permit the use of such metal. As new information becomes available on the successful applications of secondary aluminum alloys, it is hoped that some of this resistance will disappear.

For the services and industry to use "secondary" alumi-

IN THE NEWS
WITH BANTAM BEARINGS

70 TONS OF FLYING BOAT, the Mars provides a new cargo carrier of tremendous speed, and offers a forecast of the aerial transportation of the future. Built for the Navy by The Glenn L. Martin Company, the Mars, with its 200-foot wing spread and its four 2000-HP motors, requires a giant beaching gear to maneuver it on land. And in the gear the entire load is carried on large size Bantam Ball Thrust Bearings made of stainless steel to resist attack by salt air and water—another instance of Bantam's skill in supplying bearings for radically new requirements.

THE GENERAL GRANTS CAN TAKE IT, as these 30-ton tanks conclusively demonstrated in the Egyptian campaign. And in the tank transmissions, Quill Bearings are again proving their ability to perform efficiently and reliably under the most severe service conditions. For further information on this compact, high-capacity anti-friction bearing, write for Bulletin H-104.

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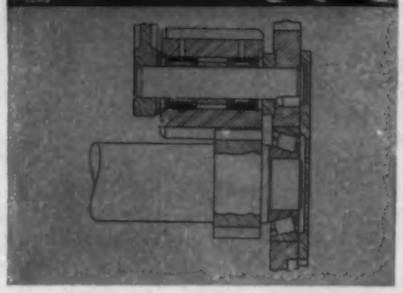

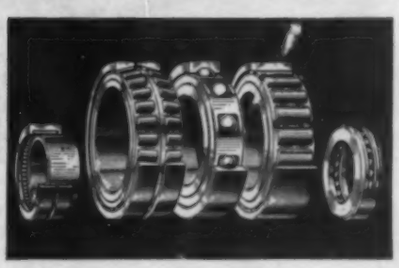

FROM TOWING WINCH TO CRANE by the addition of a boom is the transformation undergone by this versatile Willamette Hyster winch, now handling scrap in a metal refining plant. Winches of this type use Bantam Quill Bearings on reverse idler pinion (as shown in cross-section drawing) and in idler gear.

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num, they must know what compositions and what quantities of such compositions are available. As all this is under the control of WPB, that agency should supply the information. Although WPB has ruled that secondary aluminum must be used for certain castings, *it has failed to gather and supply information as to what constitutes this secondary aluminum.* This forces users to go to the individual secondary smelters and get what information they can. All such information is sketchy and temporary because the secondary smelters can only say what they have in sight today and have no way of knowing what WPB will do next in connection with routing scrap. In spite of this condition, progress is considerable.

Pearlitic Malleable Irons Find Many New Uses in War Production

BY J. H. SMITH
General Manager
Saginaw Malleable Iron Division
General Motors Corp., Saginaw, Mich.

■ WITH THE advent of all-out war, pearlitic malleable iron assumed real importance in industry's war assignment. Thousands of tons are being produced yearly to replace critical steels needed so badly for ships, planes, etc., at the same time saving many machine tools, and countless man hours in machining time. The importance of this material in many peacetime applications, together with the advantage offered in production of those parts led to its adoption in parts for many war items such as small arms, ammunition, marine diesel engines, transmissions, tank and truck parts and many other applications.

ArmaSteel is one of these pearlitic malleable irons. Produced under the most rigid technical control, it was developed to provide industry with a cast ferrous product combining high yield strength, adaptability to selective hardening with good machineability, and having other features that make it comparable to steel in many qualities. Engineering and metallurgical staffs continue to develop new applications for this material in the war program.

Diecasting Uses Low Grade Metal, Saves Virgin Aluminum Supplies

BY D. L. COLWELL
Chief, Nonferrous Metals Substitution Section
War Production Board, Washington

■ DUE TO the critical shortage of aluminum, it was necessary a year ago to reduce the aluminum content of zinc-base diecasting alloys from 4 to 2 per cent, increasing the zinc content accordingly. With the increased production of cartridge brass, the demand for high purity zinc for cartridge brass has been so great that this metal is even more critical than low grade aluminum. The restriction on this use of aluminum, therefore, has been relaxed. Casters are free to go back to their 4 per cent composition.

"Low grade aluminum" is defined as aluminum containing 4 per cent of copper and 1 per cent of either zinc or iron. This amount of copper adds about 0.16 per cent to the zinc-base alloy. In the case of No. XXIII alloy which is nominally copper-free, revisions in specifications have been made from 0.10 per cent maximum to 0.25 per cent maximum. It should be pointed out that this "low grade aluminum" should be purchased with a rigid limit of 0.10 per cent each on the lead and tin as these materials are particularly harmful to zinc-base diecasting alloys.

In the field of aluminum diecasting, there has been considerable activity in military applications due to the ability of the diecasting process to use lower grade material. Diecastings containing 4 per cent copper, and between 5 and 9 per cent silicon have been widely used, serving as a substitute for virgin aluminum castings and screw machine stock. Diecasting thus has been used to advantage in the conservation of aluminum. During the coming year it is expected that increased supplies of magnesium will make this material available as a substitute for aluminum in many casting applications.

Gray Iron Foundries Maintain Quality Despite Material Supply Difficulties

BY H. S. WASHBURN
President
The Plainville Casting Co., Plainville, Conn.

■ MUCH DEVELOPMENT work in gray iron foundries can not be discussed at the present time because of wartime restrictions but one job is being accomplished which deserves comment. During the past few years, the gray iron foundry industry has made notable advances in the production of high-tensile irons and special mixtures for castings tested under high pressure. During that period the manufacturers of the materials we use have made possible our development work by giving us continually better grades of material.

Today, with decidedly inferior quality in some of our materials and with the necessity for entirely eliminating the use of some alloys and the necessity of finding substitute methods, it is amazing to note that the quality of the product is being maintained and that the rigid specifications demanded in war production work are being met.

Centrifugal Casting Tubular Shapes Important Development

BY RAYMOND L. COLLIER
Secretary
Steel Founders' Society of America, Cleveland

■ ONE OF THE most significant developments in steel castings is the pioneering work done on centrifugally casting long tubular shapes up to 16 feet long and with side walls up to several inches in thickness. The ingenious methods employed make possible the integral casting of flanges on the end of such sections, if desired. The technique appears promising for future exploitation.

The laws of directional solidification in steel castings have been studied by a growing number of foundries which have thus been able to "lick" hitherto "uncastable" jobs. Expert use of chills has accomplished seemingly impossible results. Banks of infrared lamps are being used for the rapid expulsion of moisture from dry sand molds. Special broaching tools have been designed and built for high speed finishing of cored holes in castings. There is a definite trend toward quench-and-temper heat treatments due to the impressive mechanical properties which such treatment imparts to cast steels.

The new NE steels in cast form are being studied by more and more steel foundries. Scattered reports to date suggest the possibility of these steels becoming increasingly popular both during and after the war. The well-organized work of the technical and operating groups of the Steel Founders' Society of America has gone forward in spite of heavy operating schedules which leave

little free time for plant executives and technical supervisors. These group studies are resulting in improvements in quality of steel castings.

Steel Castings Output Rises To Meet Requirements of War

BY F. A. MELMOTH
The Detroit Steel Casting Co.
Detroit, Mich.

■ IN THE STEEL foundry, the year 1942 was remarkable principally for the striking advances made in volume production. All possible effort was bent toward the adaptation of the largest number of parts to machine production, and foundry ingenuity has been allowed full play to achieve it successfully. The result was a record-breaking output with no falling off of quality but rather a steady development of this always essential factor. The enormous increase in the percentage of production subjected to severe specification requirements has intensified the importance of nondestructive types of testing and examination.

Technical associations have kept step by setting up committees solely for the study of war production problems, and the dissemination of reliable advice and assistance. This is all the more valuable owing to the necessity of converting foundry facilities to those special products vital to the war effort. The remarkable success achieved by many of these conversions will have a constantly enlarging beneficial effect. Skilled labor presents the most crucial production problem and will continue to do so. The necessity for careful balance between military needs and those of an adequate skilled labor force to work efficiently is already very apparent.

Blast Cleaning Equipment Now Provides Increased Speeds, Needs Less Attention

BY D. C. TURNBULL
Chief Engineer
American Foundry Equipment Co., Mishawaka, Indiana

■ WITH CONSERVATION of materials and equipment assuming the greatest importance in our national war effort, airless blast cleaning equipment is playing a more important role. In meeting the heavy demands of war industries for blast cleaning equipment, many problems have been solved successfully with the Wheelabrator, a mechanical blast method using centrifugal force instead of compressed air. Advances in this field during 1942 involved the development of new equipment designs for handling such products as rifles, bombs, armor-piercing shells, aircraft engines, tank bogie wheels and tractor treads, armor plate and a host of other essential military equipment.

In the case of shells and bombs, it was necessary to retain the use of compressed air for blasting internal cavities because of the small end openings, but methods were devised to utilize the compressed air more economically than ever before. A combination machine was developed for shells and bombs in which both the interior and exterior surfaces can be cleaned simultaneously in a single machine, using one operator. Extreme flexibility was maintained in the design as evidenced by the fact that one standard shell machine can handle any size shell from 75 millimeter to 6 inches by a simple change of fixtures. Most significant of all these developments is that cleaning speeds have been increased as never before, space has been conserved, man-power has been reduced, and cleaning quality greatly improved.

Service or Proof Tests Replace Mechanical Properties in "Specs"

BY H. A. SCHWARTZ
Manager of Research
National Malleable and Steel Castings Co.,
Cleveland

■ TWO THINGS seem outstanding in foundry practice: First is the increased interest in "pearlitic" malleable iron displayed by various governmental agencies. This may well lead to introduction of this material into civilian uses after the war for purposes not heretofore contemplated. Second is the effect which the growing scarcity of the alloying elements has in making it more and more necessary to rely upon plain carbon steels or very nearly plain carbon steels. This has promoted an enormous interest in the effect of very small amounts of unusual alloys especially from the viewpoint of hardenability. It has also concentrated attention upon improved steel making practice. Possibly a third development is a trend deserving much commendation toward judging of the suitability of a given metal for the intended use by service or proof tests rather than by conformity to some particular mechanical properties which have been deemed necessary, often on insufficient grounds.

Carbide Tool Output Already 50 Times 1940, Still Rising

BY H. W. HIGHRITER
Chief Metallurgical Engineer
Vascoloy-Ramet Corp., North Chicago, Ill.

■ THE PAST year has seen continued increased demand for and production of carbide cutting tools. How to continue multiplying an output already well over 50 times the 1940 level has been a major problem. Steel-cutting grades have continued to lead in this expansion and now constitute the majority of current production for tools. Simplification and standardization of tools, tips and types of carbides have made notable progress in the past year and increased production has been favored thereby. So far no substitutes for essential and preferred component materials has been necessary, and prospects appear good for continued ample supplies. Both users and producers of carbide tools have gained in knowledge and skill in such phases as tool design, regrinding, etc., partly from educational work by certain manufacturers. A result has been widening of the successful application of carbide tools, especially on larger machines such as engine lathes, boring mills, planers, shapers, etc. Increased use is being made of carbide-tipped milling cutters, especially of the inserted-blade type, for milling steel, cast iron and nonferrous metals. Use of negative rakes has contributed to these applications.

The field of carbide dies has experienced two noticeable trends. In wire-drawing dies, the demand has been heaviest in small hole sizes, 0.007 or 0.005 inch. Use of large dies for nosing shells and for forming other parts has increased, while there have been interesting and successful applications both in drawing cartridge cases and forming small caliber ammunition. Cast nonferrous cutting alloys have also found increased use in the field intermedi-

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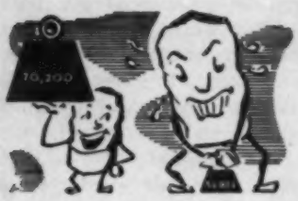
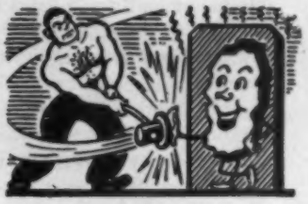


Strength



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Cleansing Agents, such as ferromanganese, silicomanganese, ferrosilicon, zirconium, calcium-silicon, calcium-manganese-silicon, and calcium metal, act as cleansers to eliminate impurities in steel. They do one or more of these jobs:

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3. **Literature.** Booklets and reprints of technical articles give information on the correct use of ferro-alloys and the applications of alloy steels and irons. Among these are "Chromium in Cast Iron," "Nitrogen in Chromium Alloy Steels," "Using Ferro-Alloys in the Iron Foundry," "Vanadium in Steel and Iron—A Review," and "Electromet Products and Services." Write for any of these that would be helpful to you.

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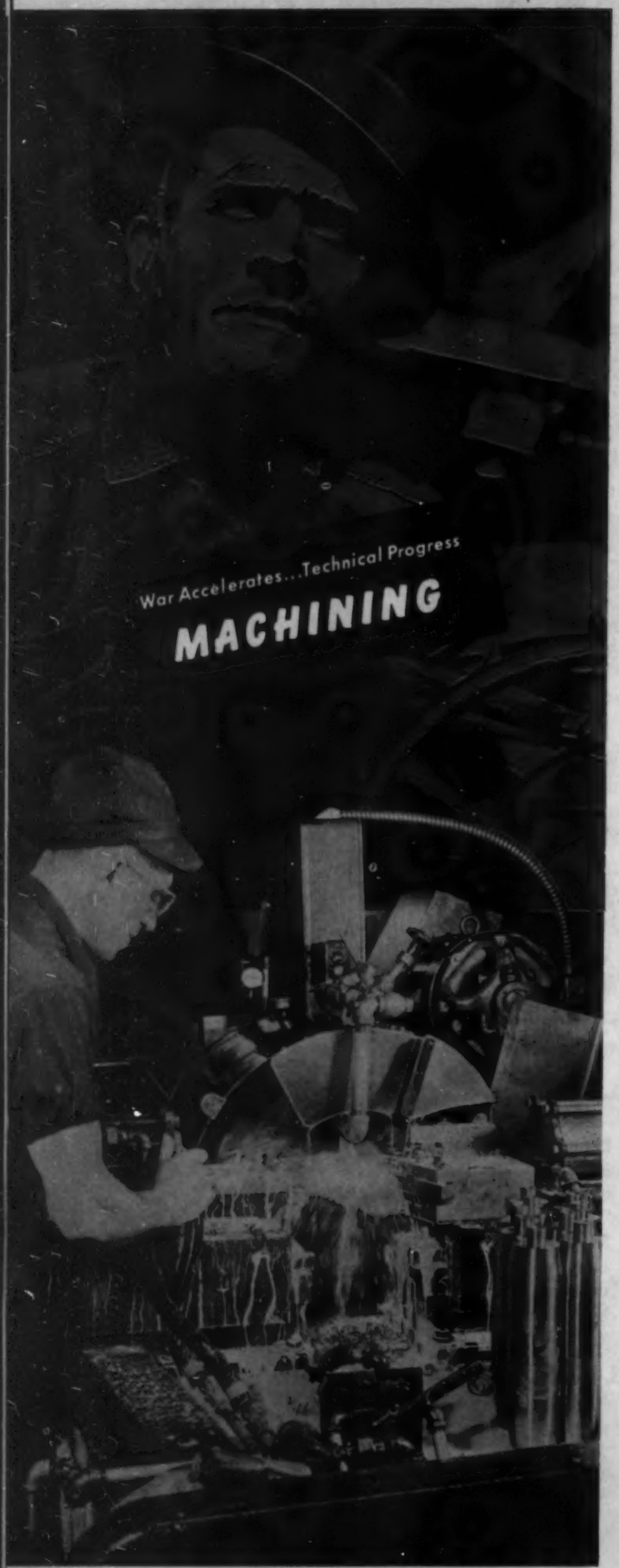

Official O.W.I. Photo by Palmer

ate between high-speed steel and sintered carbides. Their ability to be cast to approximate shape has led to use for a variety of special tools such as end mills, drills and milling and other special cutters.

New Milling Method Increases Speed 10 Times, Feed 6 Times

BY MALCOLM F. JUDKINS
Chief Engineer, Firthite Division
Firth-Sterling Steel Co., McKeesport, Pa.

■ A NEW METHOD of face-milling steel with Firthite sintered-carbide-tipped inserted-blade cutters has not only increased production but also has been applied to the milling of hardened and heat-treated steels, including alloy and other tough steels which either are difficult or practically impossible to work by the more conventional methods. Known as "Hyper-Milling," the process involves the use of teeth ground to a 10-degree negative radial rake and a 5-degree negative helix. While the usual milling cutter might be compared to a carpenter's plane in which the tool digs into the work, the new method is comparable to a carpenter's scraper in which the angle of the tool is reversed. In some respects, hyper-milling is like an ordinary milling cutter working backward, with teeth reversed and at higher speed.

Advantages of hyper-milling are manifold. The cutting edge is greatly strengthened as a lip angle greater than 90 degrees is used. The center of the cutting pressure is some distance behind the cutting edge. The negative angles delay cratering, pitting, wear, and chipping. Despite the omission of any cutting fluid, both the work and the cutter remain cool, resulting in a minimum of distortion, even of fragile pieces. The light feed results in less strain on the work and on the machine. The speeds are up to ten times those of high-speed steel cutters, with six times the feed. Production has been increased from two to four times in many cases by use of hyper-milling.

Variable Speed Electric Drive Meets Wartime Conditions

BY J. W. COREY
Sales Vice President
Reliance Electric & Engineering Co.
Cleveland

■ ONE OF the most outstanding developments in the machine tool field during 1942 has been the redesign of many boring mills, lathes, grinders, drills and other machines to permit the substitution of electrical for mechanical means of obtaining the range of speeds necessary for their most productive operation. Four factors, the result of conditions brought about by the war, have served to accelerate this trend away from a dependence upon complicated gear trains and shifting levers. Undoubtedly the most important consideration in hastening change in design has been the war-born and growing scarcity of alloy steels for gears. At the same time the volume of work already imposed on all available heat treating facilities makes it difficult to make gears from substitute carbon steels—which incidentally also are becoming scarce.

A second factor is the desirability of simplifying, so far as possible machine tool controls to facilitate operation by men and women without previous experience. With the rapid increase in employment of inexperienced work-

ers, particularly women, simplified labor saving controls on machines have become of great importance in speeding up the training of these new workers, holding fatigue to a minimum and protecting these operators from injuries.

A third consideration which has assumed considerable importance is the kind and amount of electric power available to drive machine tools. This problem has intensified in recent months as more machine tools have been distributed to plants with limited direct current facilities. Under the circumstances an all-electric adjustable speed drive which operates from existing alternating current distribution lines, not only conserves scarce alloy steel and copper but also provides a range of speeds which is considerably more extensive in most of the applications already made than had been available on the same machines when depending on change gears.

A final factor has been the increased production, frequently 10 to 15 per cent or even more, which machine tool builders themselves have reported as possible when their equipment is operated at exactly the right speed for each particular job. With an all-electric variable speed drive it becomes a simple matter to change quickly and easily from one speed to another, at the turn of a knob, or to make speed changes an automatic procedure by adding electrical controls to perform this function for the operator.

Size of a machine tool has no bearing on the usefulness of this type of electrical adjustable speed drive. Several thousand smaller units, for example, have been installed on 10-inch lathes used primarily in tool rooms to produce small parts, while several hundred large units now are being built for use on big boring mills on which turrets for the new "General Sherman" tanks will be machined.

Ordnance Machine Tool Panels Encourage Sub-Contracting

BY BRIG. GEN. H. F. SAFFORD
Chief, Production Service Branch
Industrial Division
Office, Chief of Ordnance, Washington

■ THE ORDNANCE Department has just completed its greatest year of expansion in history and the close of 1942 has found its tooling program well advanced. Production schedules have been met or exceeded, with few exceptions. This has only been made possible by the wholehearted co-operation of industry in general and the machine tool builders in particular. Expansion of the machine tool industry has been phenomenal and is a tribute to the unselfish patriotism of its members.

To assist in equipping rapidly to meet sharply rising production schedules, the Ordnance Department has given every encouragement to its contractors to utilize available equipment to the maximum, even though in many cases such equipment is not the most efficient. Advantage has been taken of available management, personnel and equipment by encouraging greater use of sub-contractors. Further efforts in this direction will continue. The Ordnance Machine Tool Panels have been of great help in this important work.

As more and more trained mechanics are required by the armed forces for maintenance of our mechanical equipment, output of each trained man and woman in industry will have to be increased from now on by the use of more efficient machine tools and material handling equipment. Where temporary and less efficient methods were used to get production started, replacement by more efficient equipment will now become necessary. Except for such replacements, Ordnance requirements for new machine tools in 1943 will be greatly reduced. In my opinion, the day is not very distant when the highly trained personnel and accurate equipment in plants of certain machine tool builders will make further contributions to the war effort by producing munitions requiring a high degree of accuracy and skill.

Materials Used in Machine Tools May Be Modified Permanently

BY FREDERICK V. GEIER
President
Cincinnati Milling Machine Co., Cincinnati

■ MACHINE tool builders and engineers have had an extraordinary range of problems to meet in the 12 months since Pearl Harbor. The year began with intense efforts further to expand production through plant additions and expansion of working shifts. The increased output brought an opportunity for builders of machine tools to use production machining lines, special purpose tools and line assembly methods on an entirely new scale.

Beginning with the virtual elimination of aluminum from machine tools, there has been a continuous process of substitution of steels and other materials to avoid the use of scarce alloys. While this has taxed the ingenuity of machine tool engineers and metallurgists to keep production lines running, it is not unlikely that some of these material changes may permanently modify traditional materials used.

Machine tool engineers have been concurrently engaged in finding production methods and designing equipment to make possible mass production of new armament components the like of which are unknown in peace-time products. Combat requirements and wartime conditions have frequently left no time to redesign armament parts for economical production, in which cases ingenious machine tool equipment has been developed in record breaking time to machine some of these intricate parts on a quantity production basis. The problems solved during the past year definitely have contributed to the versatility of machine tool engineers.

Mass Produced, Accurate Gears Have Major Part in This War

BY O. L. BARD
President
Michigan Tool Co., Detroit

■ ONE OF the outstanding developments in war tooling during the past year has been the rapid conversion from relatively slow production methods to high-precision mass-production of gears for war equipment. This war—as no war ever was before—is a war of motion. Wherever you have motion you need gears. When it became necessary to produce gears in tremendous quantities for airplanes and engines, for tanks and ships, for firing controls and torpedoes, etc., it became imperative to revolutionize traditional existing gear production methods.

Previously, gears for such purposes had been produced to a considerable extent by "toolroom" procedures. Multi-

plying production, while retaining the same processes would have been almost a physical impossibility due to the tremendous amount of equipment and skilled manpower required. Fortunately private industry already had developed gear production machines and cutters to a point where it was possible to produce gears for automobiles for instance, to extremely close tolerances and on a large scale. These machines were found readily adaptable to most high precision gearing required for war products and are today producing such gears to accuracies frequently surpassing even those obtained by slower tool-room methods.

In addition, special automatic machinery also had to be developed in some cases to relieve the shortage in skilled manpower. This was particularly true in connection with some of the newer forms of double-enveloping gearing, demand for which was greatly accelerated by war requirements for higher-load-capacity and lighter weight gearing. With this tremendous increase in use of high output gear production equipment it also became desirable to simplify and speed production of cutting tools for such machines. As one result, many organizations engaged in large scale gear production today are producing their own hobs, form cutters, etc., on special universal machines developed originally by tool manufacturers for general tool room usage—design of which has been based on their own successful manufacturing experience.

Oxy-Acetylene Cutting Is Vital Both in Repair and Production

BY R. S. BABCOCK

Development Engineer
The Linde Air Products Co., New York

■ EXPANDING production of war materials and transportation equipment has increased the use of oxyacetylene cutting because of the ease with which steel parts can be shaped by this method. Steel plates for fabricated structures rapidly can be cut to size and where required their edges simultaneously can be beveled to the shapes most suitable in connection with welding the assembled structure. In many instances considerable reduction in machining time has been attained through shape-cutting—thereby increasing the production rate.

Oxyacetylene cutting has made it possible for steel mills to maintain rolling schedules when breakdown of shears or other severing apparatus threatened mill shutdown. Similarly, bottlenecks have been eliminated in mills rolling material exceeding their original shear capacity. Increased cutting speeds have been attained through use of improved technique on hot steel plate. With increased production in foundries of heavy industry, improved equipment and methods for oxyacetylene cutting have been developed to remove risers and hot top sections from large castings. Cutting to closer tolerances has reduced conditioning time with resulting increase in production.

Special cutting machines have been developed to handle the large plate section used in ship construction. By the use of improved cutting technique it has been possible to double the speeds previously attained. Oxyacetylene cutting continues to grow with the increase in shipbuilding because of its ability to form correct plate-edge profiles used in welding. Because of the essential nature of the nonferrous metals used in oxyacetylene cutting blowpipes and nozzles, it is now more important than ever before to maintain equipment in good operating condition. Nozzle designs have been revised to give longer operating life and methods of repairing nozzles have been prompted. Certain new nozzle designs also have been brought out which permit increased operating speeds with appreciable saving in oxygen and acetylene consumption.

Now Is Time To Build Quality Into Men As Well As Machines

BY E. S. SAWTELL

Vice President and General Manager
Tool Steel Gear and Pinion Co., Cincinnati

■ MODERN production — uninterrupted production—no breakdowns. These must be our watchwords today. The units of production must be built with maximum quality in every part to give uninterrupted production. Shortage of skilled workers and trained mechanics intensifies the problem if a machine needs to be overhauled or repaired.

In our opinion, the last year or two has produced a much vital interest in high quality equipment and in high quality maintenance parts. Price has become entirely secondary consideration and—except in emergency breakdowns—quality has been more important than quick deliveries. Just as better quality must be built into our equipment, so unusual efforts must be made to build quality into our workmen. Systems for intensive training of the unskilled, continued efforts to explain and explain again the functions of the job, are bearing fruit. Today when we must employ many who would normally be rejected, we may be doing our country and industry in general a tremendous service if—while employing—we train and educate these men out of the marginal class and fit them for future usefulness.

Carbide Tool Developments Solve Tough Production Problems

BY K. R. BEARDSLEE

Carboloy Co. Inc.
Detroit

■ TREMENDOUS acceleration in metal cutting resulting from continuous increases in war production schedules during 1942 brought with it two long awaited developments in connection with the use of carbide cutting tools: (1) General acceptance of such tools for machining of steel; and (2) wide-scale adoption of standard rather than special tools. The amount of metal being machined with carbide-tipped tools as of the end of 1942 is being variously estimated as representing 30 to 50 per cent of all the chips produced by all forms of tools. Since war products on the whole employ more steel than peacetime products, the proportion of carbide tools produced by steel-cutting on the one hand, and cast iron and nonferrous metals on the other hand, has been almost reversed during the past year. At the same time, total output of carbide tools every month today represents the output of several years prior to the war.

Prime reason underlying this development has been the necessity for obtaining maximum output per machine and per man hour. For the first time since this country went into the great depression more than 12 years ago, maximum output has become a prime consideration. Widespread adoption of standard tools where formerly

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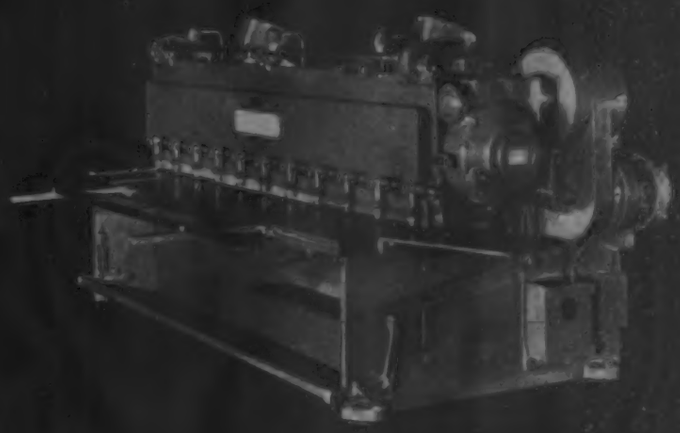

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specially designed tools would have been used, has come about largely as the result of educational work. Such standard tools were available from this company for some time prior to the war, but one of their prime advantages—quick delivery—represented little advantage to the user until he was pushed for output, quick tooling and quick tool replacement.

As the result of development and availability of carbide tools, we are able today to produce many tanks, guns, and shell for which we would not have had the capacity without such tools. They have solved the problem of machining of cast armor plate. Carbide dies have enabled switching from brass to steel cartridge cases—a move made necessary by shortages of critical materials. In turn, tremendous increase in use of carbide tools of all types has made possible design standardization of still further sizes and varieties of carbide tools and dies for mass production, thereby further simplifying and expediting ordering and delivery of many additional types of these widely used tools.

As Production Program Develops Tool Engineers' Problems Grow

BY O. W. WINTER
President
American Society of Tool Engineers

■ UNQUESTIONABLY the biggest problem that faces America today is the shortage of manpower and particularly the shortage of technically trained manpower. The American Society of Tool Engineers foresaw this situation in the early part of 1940, when a survey conducted by the Society indicated that there then existed a shortage of approximately 1,250,000 machinists, toolmakers, tool designers and tool engineers. Today the War Manpower Commission claims that there is a need for 51 tool designers and tool engineers for every one available. This condition exists despite strenuous efforts to advance men quickly by upgrading and other intensive educational program. This shortage exists despite all the assistance, both technically advisory and administrative, that ASTE has lent to this all important industrial training program. The fact remains that our job has only begun, the fact also remains that men cannot be trained as real tool engineers in a few weeks or even in a few months.

We hear a great deal these days of the importance and real necessity for employing women in industry. We simply cannot man an army and at the same time operate industry in any other way. We hear a great deal about training women up to the level of the job. We have heard little or nothing about tooling the job down to the woman's level. A woman can be trained in a short space of time—despite her lack of technical background—up to a certain degree of skill and knowledge of mechanical things. If we wait to train her all the way, we definitely are slowing down the general program. Furthermore, if we attempt to put women on many jobs in industry as they are now tooled up, we find that there is definitely too much downright drudgery involved and too much physical strength required.

The tool engineer faces a major challenge to his Yankee ingenuity, now that he is required to devise practical ways and means to attain "effortless production." Our conversion heretofore has been conversion from peacetime men's jobs to a wartime men's jobs. Perhaps in some cases we might go so far as to say a conversion from peacetime skilled men's jobs to a wartime unskilled men's jobs, but that point might be debated. The fact remains that wartime conversion now is to unskilled and relatively physically weak women's jobs. In other words, we now will have to "put that piece of pipe back on the wrench handle."

More Effective Intensive Use Can Be Made of Existing Tools

BY A. G. BRYANT
President
Bryant Machinery & Engineering Co., Chicago

■ FOR THREE years the machine tool industry has been engaged in expanding enormously America's production facilities. In this period $2,500,000,000 worth of machine tools have been produced, representing 25 years of effort at the average rate of the industry for the ten year period of 1929 to 1938 inclusive. Modern machine tools by thousands have been installed and quickly put to the task of making weapons to beat the Axis. This machinery, conceived by American ingenuity, was designed to produce only under the guiding hands of skilled artisans directed by competent management. However, it now has been intrusted in many cases—out of necessity—to relatively inexperienced operators under hastily organized managerial setups. It is not strange that there has been abuse of much new machinery. It is no mystery why production in some quarters has lagged. The cause has been not so much a lack of spirit as it has been a lack of "know-how."

Those of us who have seen high-heeled cowboy boots protruding below the overalls of machine operators in plants in our great southwest and who have seen girls operating anything from milling machines to huge traveling cranes can only be amazed that this personnel could have been mobilized and even partially trained in so short a period. With this understanding and explanation we realize fully that having to a considerable extent completed the first phase of our effort—namely, the construction of great facilities for production—we now are entering a stage where we must concentrate upon better utilization of plant and equipment.

Improved Industrial Relations Inspire Production Gains

BY LEE H. HILL
Vice President in Charge of Industrial Relations
Allis-Chalmers Mfg. Co., Milwaukee

■ THE MOST significant developments in industrial relations during 1942 were the narrowing of the field of collective bargaining and the tying of union security to the right to strike. Despite sporadic outbursts, it seems entirely possible that the strike as a major labor policy has been superceded by more orderly processes both for the war period and afterwards. It was Secretary Perkins who mentioned recently the post-war possibility that the strike might continue as a "civil" right but not as a practice.

Whatever the human relations "machinery" eventually developed may be—and industry naturally has a big stake in assuring its impartiality—public opinion is not likely to permit a return to industrial chaos or the disastrous economic losses occasioned by strikes in the past. This

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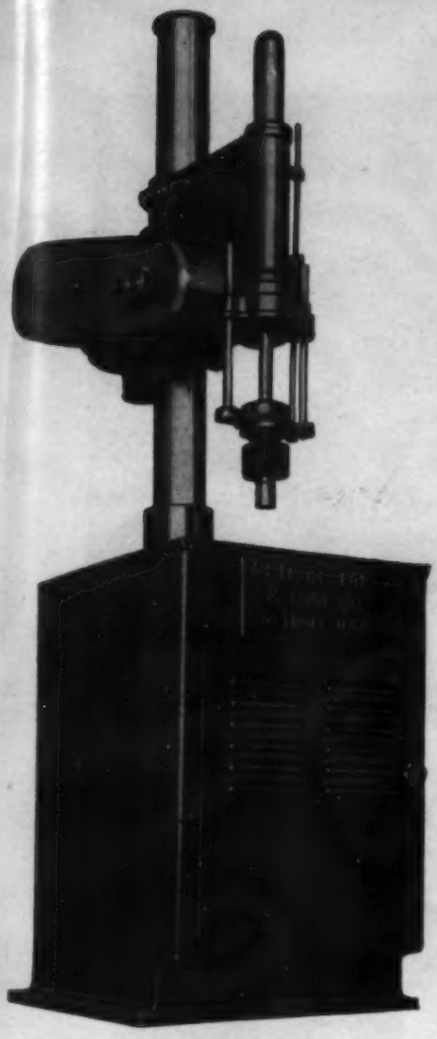

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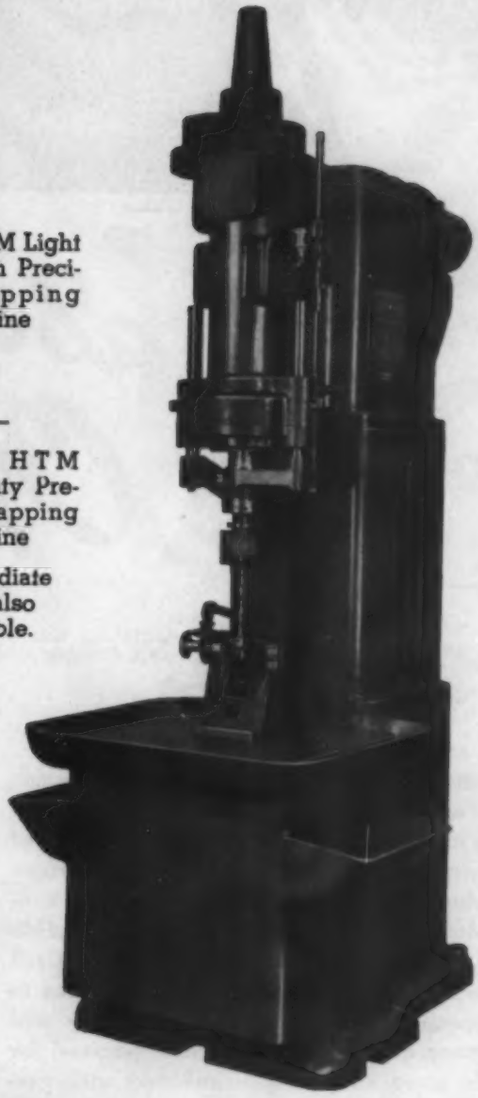

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does not mean that industry will be in a position to neglect its responsibilities in industrial relations, however. Settling of controversies by a battle of facts instead of fists requires that the facts and the conditions they represent must be all that the word "facts" implies. Industrial relations, accordingly, is advancing from a corrective stage to a period where the main responsibilities will be preventive.

The post-war period apparently will be one of stabilized wages, plentiful modern equipment and severe competition. Under such circumstances, possession of one or all of the three competitive advantages open to a manufacturer—superior management, superior sales, superior quantity and quality of production—will be directly attributable to the success of his industrial relations program.

Lessons Learned on War Work Will Help When Peace Comes

BY R. S. ELBERTY JR.
Experimental Engineer
T. W. & C. B. Sheridan Co., New York

■ AMERICAN industry has been going to school. Conversion to war work has brought us many difficult problems in the manufacturing field. For example, our company has learned how to use tools and men to better advantage. We do mass production jobs on general purpose machines and we can compete with costs established by specialists. We now have a "yardstick" to measure our own efficiency and to show where our strength and weakness lies. We do difficult machining on precision machine tool parts and we have learned to welcome hard jobs.

In our subcontract work, our customers have freely given the benefit of their experience and we are obtaining this store of manufacturing and engineering knowledge to add to our own. We have also modified much of our own machinery to support the war program. Multiply this broadening process by the thousands of manufacturing plants that have undergone this same experience, the result will show that our nation can out-build the Axis now and forever.

Women Are Proving of Real Value As Wartime Machine Operators

BY B. G. TANG
General Superintendent
General Electric Co., Schenectady, N. Y.

■ A GREAT deal of concern is being felt in some quarters relative to training of women and as to their capabilities in operating machine tools formerly operated only by men. This feeling is especially prevalent among supervisors and foremen who have had no previous experience with women on general shop work. Actually, however, this will not prove as serious a problem as one might expect—providing it be approached carefully and from the viewpoints of selection, training, and adaptation of facilities to meet the limitations inherent in women as operators of the larger machine tools.

Working conditions for women must be pleasant—they must be made comfortable. Women cannot be expected to do extremely heavy work. In this connection, changes in material handling may have to be made so a woman will not be called upon to lift heavy objects or otherwise perform feats of strength. On large tools, for example, it may be necessary to substitute air-operated chucks for hand-operated type. Incidentally, supervisors and instructors must be especially careful to be completely explicit in their instructions to women workers.

Our experience has been that selection is of paramount importance in choosing women workers. Mature women who have been occupied as housewives, for example, and who thus have developed certain capabilities in performing their duties successfully seem to grasp the requirements and seriousness of operating machine tools on war jobs much more readily than do younger, inexperienced women, or even inexperienced men for that matter. To the great credit of the many women that we have employed and are employing on men's jobs, I want to mention particularly their willingness to learn, their attentiveness to their work, their neatness and good "shop housekeeping", as well as their surprisingly quick grasp of the jobs to be done.

Warfare Waged for Destruction Paves Way for Reconstruction

BY TELL BERNA
General Manager
National Machine Tool Builders' Association
Cleveland

■ THE MACHINE tool industry has demonstrated a degree of flexibility and adaptability which it never was suspected of possessing. It is one of the paradoxes of civilization that war waged for destruction speeds up the normal curve of development in productive processes and thereby paves the way for a new chapter of advancement in the post-war reconstruction period.

Like many other industries, the machine tool industry has accelerated: (1) Elimination of unnecessary models; (2) job analysis and job simplification; (3) quick training of new men—and women; and (4) use of new and substitute materials. Machine tool builders have been called upon to adapt their machines to new uses and to design and build entirely special machines upon short notice. And before this war is over, many machine tool plants will turn their equipment to the manufacture of war requirements other than machine tools. All this varied and unusual experience of war years will enable our industry to render vitally important service in the task of reconstruction when the war is over.

New Weapons and Machine Tools Will Appear Before End of War

BY M. A. HOLLENGREEN
Vice President
Landis Tool Co., Waynesboro, Pa.

■ IN GENERAL, our war industry thus far has been tooled up largely with standard machine tools. This is true particularly of the airplane, tank and gun manufacturing branches. In the first hectic rush, tool engineers did not have time for contemplation of overall war production programs—in fact in some cases did they even know what the parts were like which they would have to machine, yet they were forced to order machines without a moment's delay. Because of this situation they naturally ordered standard machines. This phase of the program—as far as machine tool builders are concerned—is now ending. The next will be one in which most war industries

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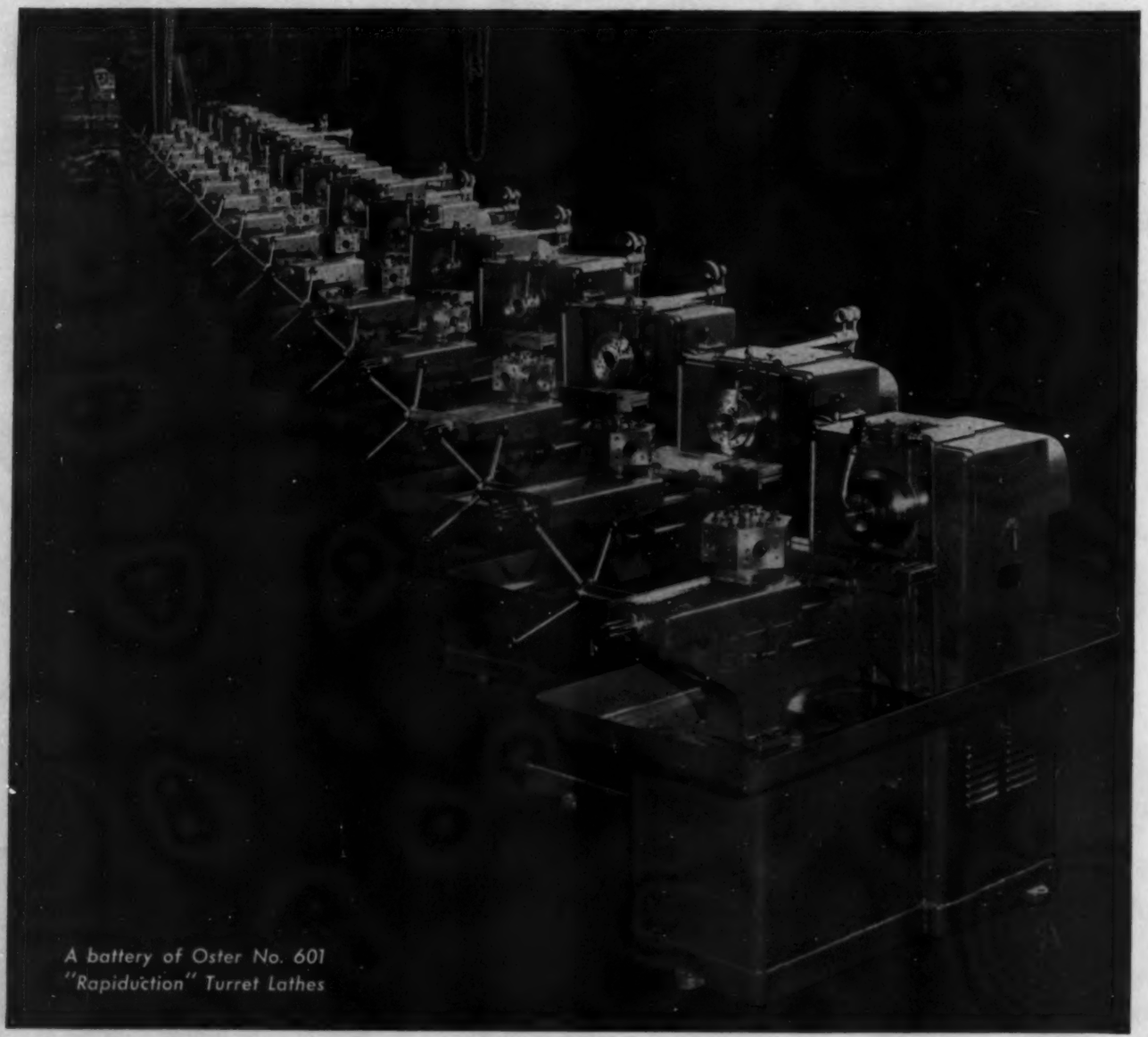

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FACT 2—You can't cram novices through a few weeks of intensive "speed-up" training and bring out highly skilled workers like rabbits out of a wizard's silk hat.

FACT 3—Many complicated, costly machines and their "know-how" operators are wasting time doing jobs that can be produced effectively on simpler machines which require less skilled operators.

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If this makes as much sense to YOU as it has to many other war production plants, let's get together and discuss details. We would like to celebrate our 50th Anniversary by helping YOU lick some of YOUR war production problems!

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will demand machines specially designed for particular jobs rather than standard units. The net effect will be to cut down the number of men and man hours required to produce an airplane engine, a gun, or other item.

It is only necessary to walk through a typical gun or airplane engine manufacturing plant to realize that hundreds of operations still are being done by hand which ultimately will have to go to machine tools. Most of these jobs will require machines designed and tooled for the particular operation involved—machines which were difficult if not impossible to get during the first rush of the tooling program. Some of the important weapons with which we are destined to win this war have not yet been designed. The same is true of the machine tools on which they will be mass produced. Within the next two years, machines of surprisingly new types will make their appearance in answer to changing demands and ever-quickening pace of our huge war industries.

Machine Tool Dealers Aid Users By Expert Technical Advice

BY F. B. SCOTT
President
Syracuse Supply Co., Syracuse, N. Y.

■ MACHINE TOOL distributors in our first year of this war have been burdened with problems of retooling of peace-time industrial plants for wartime products. Also, they have had to plan retooling for these products on available machines, rather than on tools ordinarily considered as ideal for the work in mind. Distributors also have been asked to give generously of the services of their technical personnel to the War Production Board, to help formulate practical policies in distribution of machine tools as well as to supply many field men to make surveys of industrial plants.

Field service engineers of organizations such as ours have been faced with the novel task of inducing industry to reduce to the minimum the number of machines required and to accept piece-meal deliveries of machines in line with ability to secure raw materials and trained personnel. Early in 1942 it became apparent that lack of raw materials would be a far more serious handicap to this country in achieving desired quantity of production than would any lack of machine tools.

There has been the opinion in some quarters that these technical equipment engineers have been spending their time in securing machine tool orders. This is absolutely fallacious. Any reputable machinery house with adequate telephone service could secure a volume of business beyond what their sources could supply. In order that machine tool builders could increase their production by subcontracting, it was necessary that they use many of their own field service men in supervising these subcontracts. Since servicing of machine tools is a highly technical subject, the only group left available to do this work has been the field service engineers of the distributors. These men cheerfully have rolled up their sleeves and have done a tremendous amount of demonstrating and trouble shooting to keep production flowing.

This extra service was rendered by distributor organizations without added compensation from either builders or ultimate users of the equipment. There is every indication that this important work will have to be carried still further. Some machine tool manufacturers are holding refresher courses in the care and operation of their machines. They think this is necessary due to the tremendous number of semi-trained operators now operating machine tools.

Whatever the problems are for the ensuing year—and field service certainly will be one of them—the distributors unquestionably will meet it with the same willingness and ability that they have demonstrated in the past.

Tool Heads Guided on Way of Ice Generate Machine Tool Surfaces

BY LUCIEN I. YEOMANS
Industrial Engineer
Lucien I. Yeomans, Inc., Chicago

■ REGARDING things new in the machine tool and tooling situation, as affecting the war program, a new method of building very large machine tools which we developed during the last year may be of interest. As always, the production of parts to be assembled and erected into very long or extremely large machine beds—which parts are in duplicate and should be exactly identical—presents a difficult problem. Under conventional methods, after such parts are produced as exactly as possible prior to assembly, their subsequent perfect alignment upon their foundations poses an extremely difficult problem.

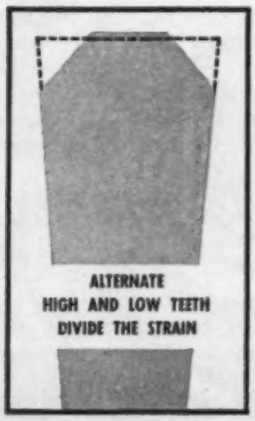
This matter has been taken care of during the past year by designs and technique which involve the permanent attachment of the bed parts to the foundation, approximately aligned and leveled, in their unmachined —in other words "as cast"—condition. They are then machined, as a unit, by means of traveling tool heads which are supported and guided upon temporary ways or reference surfaces constituted of *frozen, air-free water.* These guide surfaces are mechanically smoothed to approximately flat contour and are finished by flowing an additional thin film of distilled water over them and freezing this film by abstraction of heat through the previously solidified mass of ice.

Of course, during their period of use, the temporary ways so created are kept under refrigeration, as are also the shoes or bearings of the traveling head structures. Evaporation from the surface of the ice also is prevented. All problems involving alignment and true level are taken care of automatically and successfully by this unusual method.

NE-8600, 8700 Steels Used in Heavy Duty Transmission Gears

BY S. L. WIDRIG
Chief Metallurgist
Spicer Mfg. Corp., Toledo, O.

■ HEAVY DUTY gears must primarily possess toughness and ductility as well as resistance to fatigue. So important are these qualities that special electric and open-hearth steels were developed for this application some years ago and became known as SAE 4320. In substituting steels from the NE series, tests were made similar to those used in developing the SAE 4320 steel. Since resistance to impact of the tooth points during shifting is one of the most critical factors, a special machine was developed which enabled laboratory controlled tests to be worked out that uniformly reproduced the worst possible service conditions. Need for such a



Those three curling chips mean much to cutting efficiency and length of service. They speed up production and make the blade last longer.

The segments of the M. & M. saw blade form a closed ring which adds strength and rigidity. Each two teeth, ground alternately high and low, make a cycle. The first, or higher, tooth has the corners bevelled off at a 45-degree angle. The middle third of the cutting edge meets the work, *taking out the center of the cut.* The second or finishing tooth, slightly lower but full width, *removes the two remaining corners.*

This distributes the shock. One wide and two narrow chips are formed. The bevelled tooth does not have to "get under" the full load. The strain on the finishing tooth is likewise divided.

Strain and frictional heat per tooth are reduced. Heavier feeds lower cutting time. Squarer cutting results. The blade "lives longer."

Many other practical advantages, too. Get the full story in our new "Flyer."

THE MOTCH & MERRYWEATHER MACHINERY COMPANY
Penton Building **Cleveland, Ohio**

Built by **MOTCH & MERRYWEATHER**

MOTCH AND MERRYWEATHER THE MACHINERY CO
CLEVELAND CINCINNATI DETROIT PITTSBURGH

machine was vital, for ordinary Izod and Charpy tests gave no relation whatever of actual resistance to impact imposed by shifting gears in field tests.

We find NE-8600 series closely comparable to the SAE 4320. The best hardness range for gears appears to be from 59 to 62 rockwell, and tempered to a point where they can be touched with a testing file, the latter condition determining the tempering temperature. The NE steels are more difficult to heat treat, temperature control must be much closer. Since these steels also distort differently than the SAE steel they replace, it is necessary to make adjustments to the dies, fixtures and plugs used in carburizing operations. So far, the NE-8600 and NE-8700 series have proven most satisfactory. With few exceptions, all our gears now use one or another of the NE steels. We are fully confident that in nearly all cases, NE steels can be used satisfactorily in products made by our company.

New Production Methods Slash Machine Tool Building Time

BY WENDELL E. WHIPP
President
Monarch Machine Tool Co., Sidney, O.

■ TO MY mind, the most remarkable development experienced in the machine tool industry under the impetus of war demand has been the successful application in the industry of certain principles of mass production. With large orders for identical machines, manufacturing methods have been revolutionized. The change may be summed up briefly as follows: Formerly one operator often performed four successive operations on one machine. Today, four operators on four machines each perform one operation.

A remarkable gain in time results for two reasons: (1) Set-up time is eliminated; (2) training time is reduced because to start work a new operator need learn only one operation on a machine already set up. Even working three shifts a day seven days a week, the machine tool industry could never have achieved its present incredible rate of production without the above indicated method of job simplification. In our own plant, length of time from receipt of raw materials to shipment of finished machines has been cut to less than one-third of the pre-war period. Trial and error and transition stages have long since been passed. That is all behind us. We in the machine tool industry now know how to produce and are producing in volume and in the least possible time. Hitler please note!

Cutting Fluid Is Prime Factor In Machine Tool Performance

BY W. C. LOCKWOOD
Cutting Oil Engineer
Texas Co., New York

■ SELECTION of the correct cutting fluid for any given machining operation always has been important. Now it becomes a critical consideration, for vital machine tools must operate 24-hours a day, six or seven days a week. Proper selection of a cutting fluid for any machining operation means considering estimated maximum operating temperature of the cutting fluid, capacity of cutting fluid reservoir, kind of material being machined, type of machine tools and cutting tools, type of operations, depth of cut, cutting speeds and feeds. Ways and means of reclaiming the cutting oil also should be worked out, in line with the current oil conservation program.

Best results cannot be secured with any cutting fluid unless it is applied correctly. In many cases, it will be found desirable to relocate nozzles and add to additional pipe lines so cutting fluid is delivered effectively to the working zones in increased volume to insure maximum benefit. Cutting fluids properly selected and correctly applied will give the following added benefits: Reduced operating temperatures in machine, tools and work; maximum machine output; reduction of amount of scrap due by reducing the number of tool changes and adjustments caused by premature dulling and wear; reduced machine down time; good surface finish for longer periods between grinds; increased tool life; decreased unit cost of work through higher production and fewer rejects. Since benefits to be gained by correct choice and proper application of cutting fluids are so great, specification of these fluids should be given the same scientific consideration given to selection of cutting tools and machine tools. It is recommended that cutting oil engineers of various companies supplying cutting fluids be consulted when problems regarding cutting arise, since proper selection of cutting fluids now is recognized as a specialized and exact science.

Rehabilitated Veteran Machines Tided Us Over Critical Period

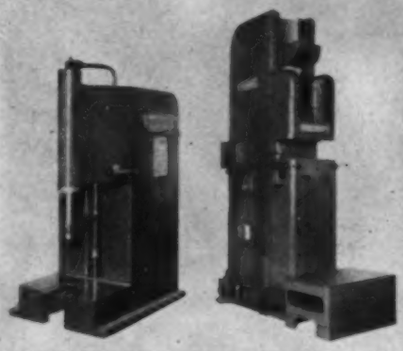
BY L. H. MALSACK
Secretary and Treasurer
Kempsmith Machine Co., Milwaukee

■ WHEN PRODUCTION requirements necessary to win a mechanized all-out war against an already well equipped foe were surveyed, our country's facilities for manufacture of the implements of war were found to be sorely lacking as far as machine tool equipment was concerned. Time was the all important consideration. The resultant "rising to the occasion" by American machine tool industry properly is acclaimed as one of the outstanding achievements of the allied war effort. Output of the industry was expanded nearly ten fold over peace time production. Current estimates indicate that this prodigious job of tooling-up for high mass-production of armaments is now at least 80 per cent complete.

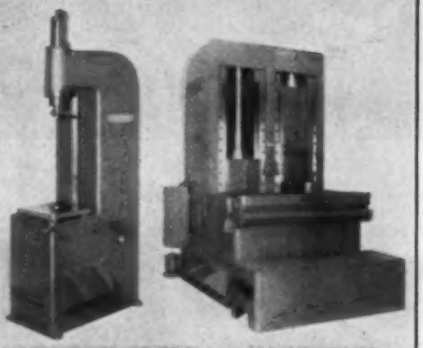
Early in this tooling-up period machine tool manufacturers and their subcontractors were among the first to discover that delivery dates on required additional equipment were in many instances exceedingly rmote. The solution was to draft into service every available machine not already being utilized on war work. In many instances smaller shops and manufacturing plants not engaged in war work, or in a remote location, were literally stripped of every usable item of equipment. Even machines in storage that had done faithful duty in the first World War were again brought into action. Not all of these warriors of earlier battles of production were suitable to the requirements of present day close tolerances and increased feeds and speeds. Therefore thorough rebuilding and converting of some of these older machines to meet new standards and requirements was in many instances the shortest route toward provision of vital machine tool equipment. Thousands of planers, boring bars, lathes, milling machines, etc., were dismantled, remachined, rescraped, motorized and otherwise rehabilitatd. When placed in

You CAN pick the wrong Machine

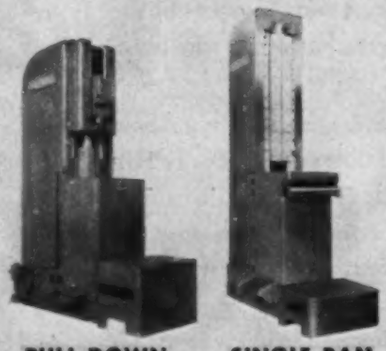
UNIVERSAL HORIZONTAL



"JUNIOR" PRESS PULL-UP



"SENIOR" PRESS DUAL RAM



PULL-DOWN SINGLE RAM

These standard Colonials come in scores of models

How to get more production with your Broaches------

3. BY PICKING THE RIGHT MACHINE FOR THE JOB

THE very flexibility of broaching machines—the variety of jobs to which each standard "Colonial" can be applied — frequently makes it difficult for the user to select the proper type of broaching machine for a specific operation or group of operations.

Proper machine selection depends primarily on three factors:

1. The nature of the job.
2. The capacity required.
3. The length of stroke needed.

Following are some hints as to selection of the best machine type for different kinds of jobs:

ROUND HOLE BROACHING: Can be handled on practically every type of standard broaching machine except those specifically designed for surface broaching. If parts are extremely large, or floor space is at a premium, a vertical machine is preferable to a horizontal type. If the operation is mainly a "sizing" job, or if the broach is not too large, a "Senior Press" may be used.

If permissible for parts to drop off the broach at the end of the stroke, and not too large to handle properly, a "Pull-up" may be used.

If the parts are too large, or if the part requires accurate locating in a fixture, a "pull-down" may be preferable.

SURFACE BROACHING: In high production, the most suitable machines are Colonial Single and Dual Ram vertical machines. If maximum production capacity is not required, a "Senior Press" may be used on light jobs. Lower production surface broaching operations may also be performed on a "Universal Horizontal" if already available. If automatic indexing is desired, a "Senior Press" or a ram type of machine should be used.

KEYWAYS: While keyways may be broached on vertical machines, it is usually best to use a "Universal Horizontal" for this work in combination with a key-way horn. This type of machine provides greater ease of loading for such work.

HELICAL SPLINES: Best performed on a "Universal Horizontal" in combination with a helical lead bar, providing maximum accuracy and ease of handling. Can also be performed on vertical machines, of course.

The above, of course, is not a complete summary and individual recommendations may differ depending on the nature of the job. As to machine capacity and length of stroke, it is always advisable to obtain the recommendation of your broaching machine and broach producer. Here the best guide is still "experience"—the knowledge acquired from tooling and studying thousands of broaching operations.

colonial BROACH COMPANY

Broaching Machines *Broaches-Broaching Equipment*

DETROIT . . . . . U. S. A.

"Take the contract and *Start Work Now* . . . we'll locate enough special-diameter drills to get you started tomorrow morning"

One of America's prominent Manufacturers recently was able to start work immediately on a heavy Emergency Contract because he had a Mill Supply Distributor who specialized in helping customers to break down emergencies.

Specifications called for holes of "out" diameter and only special drills could produce them—drills that no manufacturer could deliver within weeks.

Working with the Purchasing Department, the Distributor finally reported: "take the contract and line up production as fast as you can. I know where these millimeter drills can be had—*plenty of them* to keep you going until the factory itself can fill your order."

The contractor filled the War job on schedule—thanks to the Distributor who knew his way around and had made *his* organization a helpful, friendly part of the *Manufacturer's.*

Think of *your* Distributor today as a trustworthy purchasing and expediting assistant, trained in emergency to contact many sources of supply and to locate *somewhere* the items you need, if they can be had at all.

Supply Houses of the highest type have served for years as Distributors of Cle-Forge High Speed Drills and Peerless High-Speed Reamers. Please accept our own confidence in them as ample reason for our commending them to you—for they are located all over America and have been our Representatives for many years.

This incident is typical of the unusual services that many Mill Supply Distributors are rendering their customers during the Emergency.

ARMY NAVY

Awarded May 22, 1942
Superseded July 13, 1942

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ARMY E NAVY

Awarded August 8, 1942

"CLEVELAND" DISTRIBUTORS EVERYWHERE ARE READY TO SERVE YOU

production lines after such rejuvination, these tools rendered faithful and very creditable service. Without the help of these rejuvinated tools much vital time would have been lost. These veteran machine tools have made an all-important contribution to ultimate victory.

Unused Reservoirs of Man-Power Are Tapped by Split-Shift Plan

BY CHARLES J. STILWELL
President
Warner & Swasey Co., Cleveland

■ AT THIS writing, it seems probable that the manpower situation in machine tool plants will become far more acute in 1943 than was the case in 1942. For that reason, expedients which are proving successful in replenishing manpower lost through the draft and by enlistment are of rapidly growing importance. In our own plant, as in many others, employment and training of women has progressed amazingly and is proving highly satisfactory. In addition, however, we have inaugurated a novel plan of replenishing personnel which—on the basis of our experience thus far—I am convinced may prove widely practicable.

We have devised a split-shift program whereby, on the 4-to-12 shift, one man works on a job for the first four hours—and then a second man takes his place for the second four hours. The men doing these four-hour "tricks" are employed during the daytime at various civilian jobs not directly connected with war production.

Many Critical Materials Are Replaced by Meehanite Castings

BY OLIVER SMALLEY
President
Meehanite Metal Corp., Pittsburgh, Pa.

■ THE OUTSTANDING contribution made during 1942 by manufacturers of special high-property castings may be found in the large and important number of replacements of strategic materials which they have permitted. Literally thousands of tons of special steel, alloy, brass and bronze castings have been converted without sacrifice of quality or performance to castings which, like Meehanite, provide adequate engineering characteristics. In many cases, too, costly forgings have been replaced and in these instances, as with steel castings, savings in production time have been important particularly with respect to machining.

In spite of many obstructive elements, production has continued upward, quality has been maintained and frequently improved, and the entire foundry industry has devoted itself to providing casting users not only with a better product but with engineering service and knowledge helpful in solving new construction and fabrication problems.

The Meehanite foundries in England, Africa, Australia, Canada and the United States have placed particular emphasis upon providing practical engineering assistance to industry with respect to replacement possibilities. Cooperation among them in providing each other with application and service information has been an important factor facilitating this work.

High Speed Steel Is Conserved By Grinding Chasers Properly

BY C. N. KIRKPATRICK
President
Landis Machine Co., Waynesboro, Pa.

■ MUCH EMPHASIS now is being placed on conservation of high speed steel, particularly in connection with cutting tools made of these steels. The enormous demand for conservation of cutting tools today makes it imperative that special consideration be given to their proper use and to their correct maintenance. An important variety of cutting tools to which this situation applies consists of thread cutting chasers employed in threading machines, die heads and collapsible taps. From our experience, we know that it is essential that intensive education be devoted to the original ordering of chasers and to their grinding while in use. For instance, chasers should be ordered with throats as long as possible. Chasers with long throats produce a better finish of thread and have much longer working life than those with short threads or without throats.

Metal Industry Turns to Chemical Finishing as Plating Gets Scarce

BY D. C. MINER
E. F. Houghton & Co.
Philadelphia

■ WITH THE scarcity of plating materials to provide a protective surface finish on steel parts, the interest in the process of blackening steels by heat and chemical treatment is increasing. The metal industry today is becoming more familiar with the modern oxide or chemical black finish for steel essentially a controlled surface oxidation, producing an oxide penetration which is capable of being duplicated exactly in production.

Processes such as Houghto-Black fill a definite need in the industry. For example, this process does not change dimensional sizes and permits its use as a finish on moving parts where no changes in tolerance can be allowed. Duplication of shades of black in correctly controlled baths appeals to the metal industry because of the mass production of parts made at different times and stored for later assembly. This blackened finish also adds to appearance and salability besides protecting parts from rusting under mild conditions. It has been applied to a wide range of metal parts. As a bond for paint, the process is applied to a wide variety of articles to advantage.

Drop-Hammer Producers Meet War Demands; Forging Equipment Is Not a Bottleneck

BY MacDONALD S. REED
Chief Engineer
Erie Foundry Co., Erie, Pa.

■ A CURRENTLY outstanding factor is the emphasis placed by the aircraft building program on drop forgings of both steel and aluminum, particularly the latter. With some 3000 individual drop forgings in a single Flying Fortress, the outstanding performance and reliability of these aircraft may be attributed largely to them.

A number of large drop forge shops have been built exclusively for aluminum forgings, and several other shops have been converted. Many shops forging steel have been required by war demands to install hammers larger

War Accelerates...Technical Progress

FORGINGS

than they ever had used before. The size of aluminum forgings now being made, coupled with the difficulty of working that material, has resulted in an unprecedented demand for big steam drop hammers. However, these hammers are being supplied almost as rapidly as they can be put into service. A recent survey of drop forging shops shows that delay in getting hammers is a decidedly minor factor and not by any means the controlling one in meeting all demands for drop forgings.

Forging Equipment Makers Watch Casting, Plastics Progress

BY M. A. MONAGHAN, JR.
Vice President and General Manager
Mondie Forge Co., Inc., Cleveland

■ IN FORGING, automatic machinery has been developed to make gun shells. Too, 1942 has seen the development of the heavier type of equipment, such as 35,000-pound hammers and 8-inch upsetters. No doubt this type of equipment will have a great bearing on the economy of progress after the war—more so than can be imagined at the present time. Without doubt developments in diecastings and plastics as well as in centrifugal castings are making the forging industry sit up and take notice. However, there will always be a place for drop and upset forgings, as there are certain applications where they can never be replaced by any other type of material. Where absolute dependability has to be placed on a part, there is no substitute for a forging. That is one reason why literally thousands of forgings are found in our large airplanes such as the Flying Fortresses.

Changing Sizes, Analyses Causes Difficulties in Forging Plants

BY JOHN A. WEBBER
Metallurgical Engineer
Interstate Drop Forge Co., Milwaukee, Wis.

■ THE INTRODUCTION of the NE steels by the joint committee of the AISI and SAE in compliance with the request from the War Production Board has resulted in a rapid change in the steels which the forging industry has been able to secure during the year. The first change was to the NE 8000 series which introduce the use of manganese-molybdenum and low nickel-chromium-molybdenum as substitutes for the higher nickel and nickel-chromium alloy steels. Later in the year, however, molybdenum became even more critical than chromium and the new 9000 series was therefore added. This series makes use of the nickel, chromium, and molybdenum residuals in the scrap with almost no further additions of these elements. The silicon and manganese are also increased to improve the hardness and strength of the steels.

It now appears that the next step in conserving critical alloys will be the use of special addditions in the making of steel. These improve the strength, toughness and hardenability on those steels which are heat treated to the higher hardness values. The WPB has shown an interest in these special additions and it now looks as though their use will be encouraged as substitutes for small amounts of critical alloys.

One of the more recent problems of the forging industry has been the necessity for substitution of various sizes and analyses of steel in order to use available material.

Subcontracting, Plant Increases Up Output of Forging Equipment

BY EUGENE C. CLARKE
President
Chambersburg Engineering Co.,
Chambersburg, Pa.

■ AS OUR WAR weapons are tested in the crucible of battle, emphasis is placed on the demand for greater size and greater speed. Larger caliber guns of higher muzzle velocity as well as larger tanks and planes are the order of the day. The larger, faster, harder hitting implements of war require larger and stronger components—most of them forgings and drop forgings—for they must withstand the unpredictable. This lately recognized demand can only be satisfied by rapid but well-planned expansion of forging output.

Success in air combat usually goes to the side with the higher altitude and in a great many cases drop forged parts are essential to top altitude performance. So the drop forger—the modern blacksmith—is called upon for yet greater production. The major problem of forging equipment producers is how to quickly create more hammers and more presses, larger in size and power than those heretofore common. No efforts are being spared to accomplish this aim. Plant increases and expansion of subcontracting are both being prosecuted vigorously.

Appropriate steps to increase the production of forged and drop forged parts is a job of the authorities in Washington. Their new realization of the fact, old as the days of Tubalcain, that the blacksmith makes the armor and that, therefore, the blacksmith must first be well equipped promises to increase production of hammers yet more.

Tremendous Demand for Equipment to Forge Welded War Items Is Being Filled

BY R. H. JONES
The National Machinery Co.
Tiffin, Ohio

■ AN OUTSTANDING development in armament production is the increased use of big forging machines and presses. During World War I, the forging machine was not employed to make shell forgings because no machines available at that time possessed the accuracy of alignment and rigidity required in such work. The advent of the modern high duty type of forging machine eliminated this difficulty and is in extensive use today because it insures a sound shell forging with proper grain flow, the overall rate of production is unexcelled, the bore requires only a sand blast operation for finishing, and tool life is excellent. Furthermore, there is a vast saving in material, which reduces machining to a minimum, and diverts steel to other vital armament uses.

Added to the unprecedented demand for shell forging machines, is the vital and urgent need for forging equipment to produce cylinders, pistons, valves, supercharger impellers, propellers, nose pieces, transmission gears, bearing races and hundreds of other forgings for aircraft, ships, tanks and trucks. However, addition of a half million dollars worth of new machine tools with corresponding plant expansion is allowing production of National forging machines and Maxipresses at a rate sufficient to meet the demands being made upon us.

GETTING JITTERY, ADOLF?

WE'VE heard of your tendency to chew the carpet when things didn't go according to plan. If you've had reason for gnawing the rug before—you've really got one now. The Yanks are coming Adolf . . . they're closing in to spoil your dream of world domination, just as they spoiled the Kaiser's, 25 years ago.

We're happy and proud to be helping to put Hitler "on the carpet." Among other WELDED STEEL TUBING and Steel Forging items we're producing to make the job easier for United Nations troops, is the WELDED STEEL tent pole tubing shown above. This comes in inter-locking sections which can be adapted to tents of various sizes . . . makes them simpler to pitch . . . stronger when up . . . and handier to pack and transport.

We're still in all-out production of these, but due to fulfilled contracts on other items, we have capacity available for more war work. We want to employ our skill and experience to the utmost. If you have a WELDED STEEL TUBING or Steel Forging contract to award, let us show you what we're equipped to do.

THE STANDARD TUBE CO.

Detroit STANCO Michigan

Welded Tubing Steel Forgings

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it!"

WHAT HAPPENED in North Africa early in November was what the Steel Industry was working for . . . what every crane, car, motor, drive, reeling mill, rolling mill, table and every SKF Bearing had been striving for ever since America's freedom was first threatened.

From the very first day the Axis began to march, the Steel Industry had been preparing for North Africa with equipment that with SKF Ball and Roller Bearings met the stern challenge of Production.

SKF will see to it that not only the vital moving parts of this equipment, but of the guns, tanks, bombers, battleships and other weapons the Steel Industry produces will continue to "beat the Axis to the draw."

SKF INDUSTRIES, INC., PHILA., PENNA.

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Bearings

Britain asks: WHAT PRICE L

Many water mains were damaged during the 1940 blitz, resulting in a serious water shortage. To avert possible repetition of this, 180,000,000 gallons of static water have been stored in these five tanks, left above, in the shadow of St. Paul's Cathedral

By VINCENT DELPORT
European Editor, STEEL

British housewives look over crates of eggs, left below, domestic and from the Empire, in a London market, indicating there is no serious shortage

Convoy carrying foods, arms and raw materials nears England's shores safely, escorted by destroyers, below

Before a convoy leaves port, ship captains and naval officers confer on details of the hazardous trip. At right, merchant skippers and escort ship officers receive final instructions before leaving for Russia. NEA photos

LIBERTY?

LIBERTY, for which so many burning sacrifices are being made, is commonly thought to be a possession to which the whole of mankind aspires. While it may be that this desire is universal, it is true only to a degree, varying with peoples and individuals. Freedom must be paid for, sometimes fought for, both to obtain and to preserve it, and the price is high. At no time has this been more evident than in the present.

The more complete the freedom, the more courage, initiative, and risk are required to retain it. There are many, peoples as well as individuals, who prefer a limited freedom in order to enjoy a more secure mode of living; they tend to congregate with others; they shun responsibility; they like to be led. A nation no more liberty-minded than that is ripe for dictatorship.

Others are hungry for complete individual freedom, they are prepared to face opposition, hard struggles, insecurity and isolation to achieve it. A nation composed of such people is ripe for anarchy.

In an organized world, particularly when social and economic factors become more integrated and complicated, some limitation to individual freedom is necessary. In times like these, when communities have to fight for the principles of liberty, it is found that an increasing amount of compulsion, prohibitions and controls must come to bear on the independence of individuals and private enterprise. This is an inevitable means to an end.

Going a step further, it is evident that the war has been thrust upon the United Nations, is being waged by them not only to preserve the principle of freedom but to extend it to all mankind, and to revive the Christian spirit. We are now learning that if liberty is to be given to all peoples, each individual must give up some portion of his own freedom. As a corollary, slave-peoples and dictatorships must be forever doomed.

Once this fact is faced squarely, the implications of this war and of the peace to come are more readily understood, and it becomes possible to visualize the adjustments and changes that will be necessary if the transition from one period to another is to be accomplished smoothly.

One of the forms in which men enjoyed their freedom was to produce, manufacture and trade under the system of "private enterprise." This was by no means freedom in its fullest sense; but war has brought about in industry and trade undreamed of changes in the form of increasingly rigid fetters to the operations of individuals and companies. How much of this will remain, how much *must* remain, for the common good of mankind, when it escapes at last from the present convulsion?

Controls Will Remain After War

Already it is being recognized that many of the controls that have been imposed through war conditions upon industry and trade must be retained for an indefinite period when the war ends. There will be no complete return to prewar conditions, and the passage from wartime to peacetime activities will have to be planned and co-ordinated. Therefore, the requisite controls, suitably modified, will continue in operation.

Looking farther ahead, it is obvious that if the terms of the Atlantic Charter are to be adhered to, permanent restrictions will have to be set up against complete freedom of private enterprise. Two main directions in which such action will have to be taken will be: Control and allocation of raw materials, and equalization of basic

wages not only as between industries but also as between nations.

A brief review of the numerous rules and restrictions imposed by the state upon industrial and trade activities in Great Britain will serve to take a bearing of the present situation and may help to give an insight of what may be expected from the future.

Under the Emergency Powers (Defense) Act, 1939, the British government through defense regulations made by Order in Council is empowered to make such regulations as appear to be necessary or expedient for securing public safety, defense of the realm, maintenance of public order and prosecution of the war, and maintaining supplies and services which are essential to the life of the community.

Among other things, the Act authorizes "the taking of possession or control, on behalf of the Sovereign, of any property or undertaking; the acquisition of any property other than land; the entering and search of any premises," and it provides for amending any enactment, for suspending the operation of any enactment, and for applying any enactment with or without modification.

Soviet Ambassador M. Maisky waived diplomatic immunity that would have left the iron railings around the Soviet embassy in London, personally donned goggles and took up the torch to cut down the railings for England's scrap drive. NEA photo

Armed with these powers, the government has issued innumerable orders and regulations, a considerable proportion of which apply to industrial undertakings, and which it is impossible to enumerate here. To cite a few of main provisions will suffice to show to what extent undertakings are now restricted in freedom of action—ultimately in certain cases to the point of extinction.

One of the main regulations made by the Ministry of Labor and National Service is the Essential Work (General Provisions) Order. Under this order an establishment engaged in essential work is entered upon a Schedule of Undertakings, and while receiving certain facilities as regards supplies of raw materials and labor, it is constrained to a number of strict conditions as regards employment of labor, particularly in respect to dismissal and wages. Roughly six million employes are covered by this order.

At this point, a distinction must be made as between scheduled undertakings doing essential work, and other establishments doing only nonessential, or semiessential or part-time work. Those in the latter class finds themselves almost unprotected against wartime influences.

Raw materials, of course, have been controlled from the time the war started, and the situation is well in hand. but the problem of manpower has become increasingly difficult and urgent. If any proof is needed that Britain is all out in her war effort, the fact that 23,000,000 adults of a population of 46,000,000, are either in the fighting forces or engaged on war work can be cited as evidence.

Increasing requirements of armed forces in various theaters of war drained the supply of industrial workers. At the same time, demand for war material requires more efficiency and concentration of work. As a result, an increasing number of regulations and restrictions are being placed upon undertakings. Only in exceptional cases are men of military age deferred—when their occupation is essential and they cannot be replaced. There are no more block reservations by groups of ages. Each case is investigated and decided on its merits. Men, and women, are being taken from industries to join the forces in various ways.

Concentration of Industries Well Advanced

Some industries have been forcibly concentrated, this procedure applying mainly to the nonessential, whose output had already been restricted by the Limitations of Supplies Order. Once an industry's production has been reduced, the smaller and less efficient are taken over by the larger and better equipped, and labor is released to those doing essential work. Storage space also is made available for government purposes.

In the iron and steel and engineering industries a start has been made only in regard to iron foundries, mainly in respect to light castings; also, to a certain extent, with foundries doing only a proportion of essential work. When firms are closed down by concentration it is a condition that so-called "nucleus" firms compensate closed firms in respect to their irreducible expenses and, to a certain extent, loss of profit.

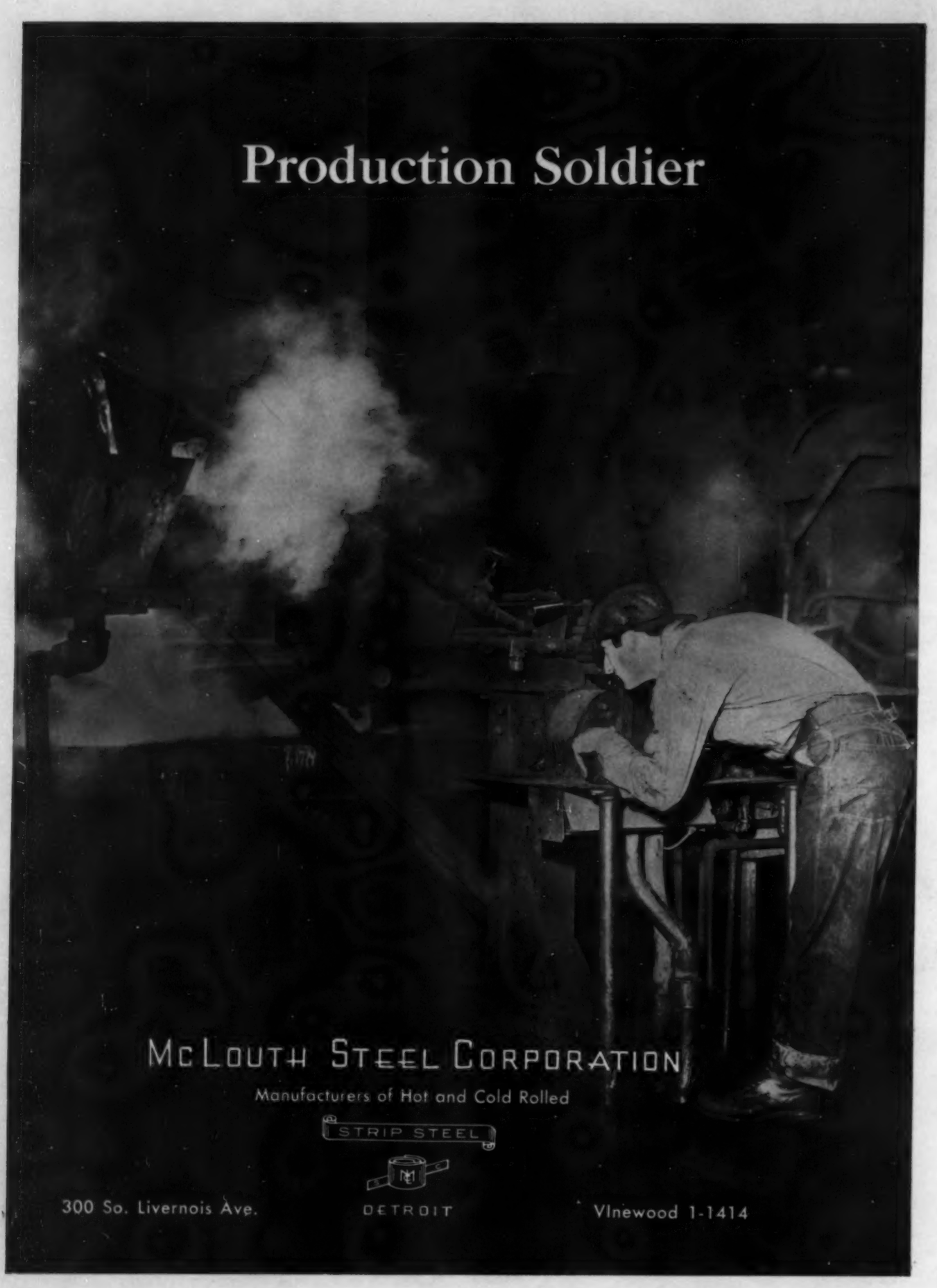
More recent and drastic powers have been taken by the Minister of Production. As the period of widespread expansion of production capacity is passing, it has been found necessary to get maximum production from resources now available. Steps are being taken to re-allocate these resources to achieve the end in view. Most important, manpower must be assigned to the right jobs, and machine tools and buildings must be used to greatest advantage.

To accomplish this the Minister may redistribute work done in each plant; or he may seek an improvement in management, or, by arranging groups or affiliation of firms, make possible a better balance. When resources

CONTINENTAL

ROLL AND STEEL FOUNDRY COMPANY

CHICAGO • PITTSBURGH


Production Soldier
McLOUTH STEEL CORPORATION
Manufacturers of Hot and Cold Rolled
STRIP STEEL
300 So. Livernois Ave.
DETROIT
VInewood 1-1414

of some plants are so meager that their only valuable asset is labor, while others are well equipped in every respect except labor, no further contracts will be given to the former and their manpower will be re-allocated to the latter.

The Minister may also move certain undertakings, especially those engaged in less essential work, from highly congested areas to other parts of the country. Plant and key personnel will be transferred, but the bulk of the labor will be left behind to be re-directed to other work near home.

Establishment of new plants will be controlled, in fairness to existing units, and to prevent further dissipation of resources. On the other hand, no mention has been made so far of any form of compensation to firms that may have to close as a result of new measures the Minister of Production is empowered to take.

The foregoing gives only a glimpse of the innumerable ways in which the government can exercise its control over industry. In brief, every avenue is blocked along which private enterprise previously could determine its own policy.

Raw materials are rationed and obtainable only in rela-

(*Please turn to Page* 361)

WORLD PRODUCTION OF STEEL INGOTS AND CASTINGS

Gross Tons

	1942	1941	1940	1939	1938	1937	1936	1935	1934	1929
United States	**76,742,562	73,963,624	60,518,419	47,672,195	28,693,000	51,526,000	48,525,000	34,467,000	26,502,000	56,433,000
Canada	**2,837,686	2,411,887	1,985,000	1,300,000	1,156,000	1,352,000	1,078,000	915,000	741,000	1,391,000
Great Britain				13,500,000	10,398,000	12,984,000	11,785,000	9,859,000	8,850,000	9,636,000
France				8,400,000	6,087,000	7,793,000	6,601,000	6,177,000	6,075,000	9,544,000
Belgium				3,000,000	2,248,000	3,801,000	3,117,000	2,975,000	2,901,000	4,066,000
Luxemburg				1,800,000	1,414,000	2,470,000	1,949,000	1,808,000	1,901,000	2,639,000
Italy				2,350,000	2,286,000	2,054,000	1,992,000	2,174,000	1,820,000	2,109,000
Spain				500,000	465,000	100,000	365,000	555,000	635,000	985,000
Sweden				1,100,000	963,000	1,088,000	962,000	882,000	848,000	683,000
Germany*				24,000,000	22,922,000	19,531,000	18,900,000	16,184,000	11,725,000	15,986,000
Austria						640,000	411,000	358,000	304,000	622,000
Czechia				1,250,000	1,733,000	2,281,000	1,463,000	1,135,000	938,000	2,103,000
Poland				1,600,000	1,517,000	1,420,000	1,123,000	930,000	831,000	1,355,000
Hungary				750,000	638,000	654,000	543,000	439,000	310,000	505,000
Russia				18,500,000	18,150,000	17,493,000	16,050,000	12,320,000	9,412,000	4,828,000
Japan†				6,300,000	6,000,000	5,718,000	5,174,000	4,858,000	3,682,000	2,249,000
India				1,000,000	966,000	895,000	866,000	862,000	798,000	575,000
Australia				1,200,000	1,151,000	1,074,000	750,000	697,000	518,000	460,000
Saar‡									1,919,000	2,174,000
Miscellaneous				900,000	900,000	900,000	800,000	750,000	450,000	400,000
World total				134,983,000	107,687,000	133,774,000	122,484,000	98,345,000	81,160,000	118,763,000

Due to war conditions figures for 1940-41-42 are not available for other than Western Hemisphere countries.

*Includes Austrian production from January 1938. †Includes Manchuria and Korea. ‡Included in Germany since 1934.
**Estimated.

WORLD PRODUCTION OF PIG IRON AND FERROALLOYS

Gross Tons

	1942	1941	1940	1939	1938	1937	1936	1935	1934	1929
United States	**48,778,284	45,042,023	42,320,011	31,943,000	19,161,000	37,127,000	31,029,000	21,373,000	16,139,000	42,614,000
Canada	**1,804,082	1,554,708	1,270,000	800,000	758,000	979,000	747,000	655,000	438,000	1,160,000
Great Britain				8,200,000	6,761,000	8,493,000	7,721,000	6,424,000	5,969,000	7,589,000
France				7,500,000	5,964,000	7,787,000	6,130,000	5,696,000	6,053,000	10,198,000
Belgium				3,000,000	2,426,000	3,743,000	3,110,000	2,982,000	2,860,000	4,030,000
Luxemburg				1,750,000	1,526,000	2,473,000	1,955,000	1,842,000	1,968,000	2,860,000
Italy				1,000,000	913,000	849,000	793,000	683,000	564,000	718,000
Spain				500,000	435,000	126,000	250,000	350,000	365,000	740,000
Sweden				625,000	652,000	682,000	623,000	603,000	550,000	516,000
Germany*				20,000,000	18,300,000	15,703,000	15,058,000	12,637,000	8,602,000	16,187,000
Austria						383,000	244,000	190,000	132,000	455,000
Czechia				1,000,000	1,215,000	1,648,000	1,122,000	798,000	591,000	1,618,000
Poland				1,000,000	952,000	712,000	575,000	388,000	376,000	693,000
Hungary				450,000	330,000	359,000	301,000	183,000	138,000	362,000
Russia				15,000,000	14,479,000	14,288,000	14,088,000	12,411,000	10,273,000	4,253,000
Japan†				3,250,000	3,000,000	2,758,000	2,823,000	2,739,000	2,400,000	1,491,000
India				1,800,000	1,634,000	1,629,000	1,543,000	1,466,000	1,331,000	1,343,000
Australia				1,100,000	1,072,000	914,000	783,000	698,000	487,000	420,000
Saar‡									1,797,000	2,071,000
Miscellaneous				1,200,000	1,150,000	1,200,000	1,000,000	800,000	700,000	750,000
World total				100,418,000	80,728,000	101,853,000	89,895,000	72,918,000	61,733,000	97,073,000

Due to war conditions figures for 1940-41-42 are not available for other than Western Hemisphere countries.

*Includes Austrian production from January 1938. †Includes Manchuria and Korea. ‡Included in Germany since 1934.
**Estimated.

IRON, STEEL EXPORTS AND IMPORTS OF PRINCIPAL COUNTRIES

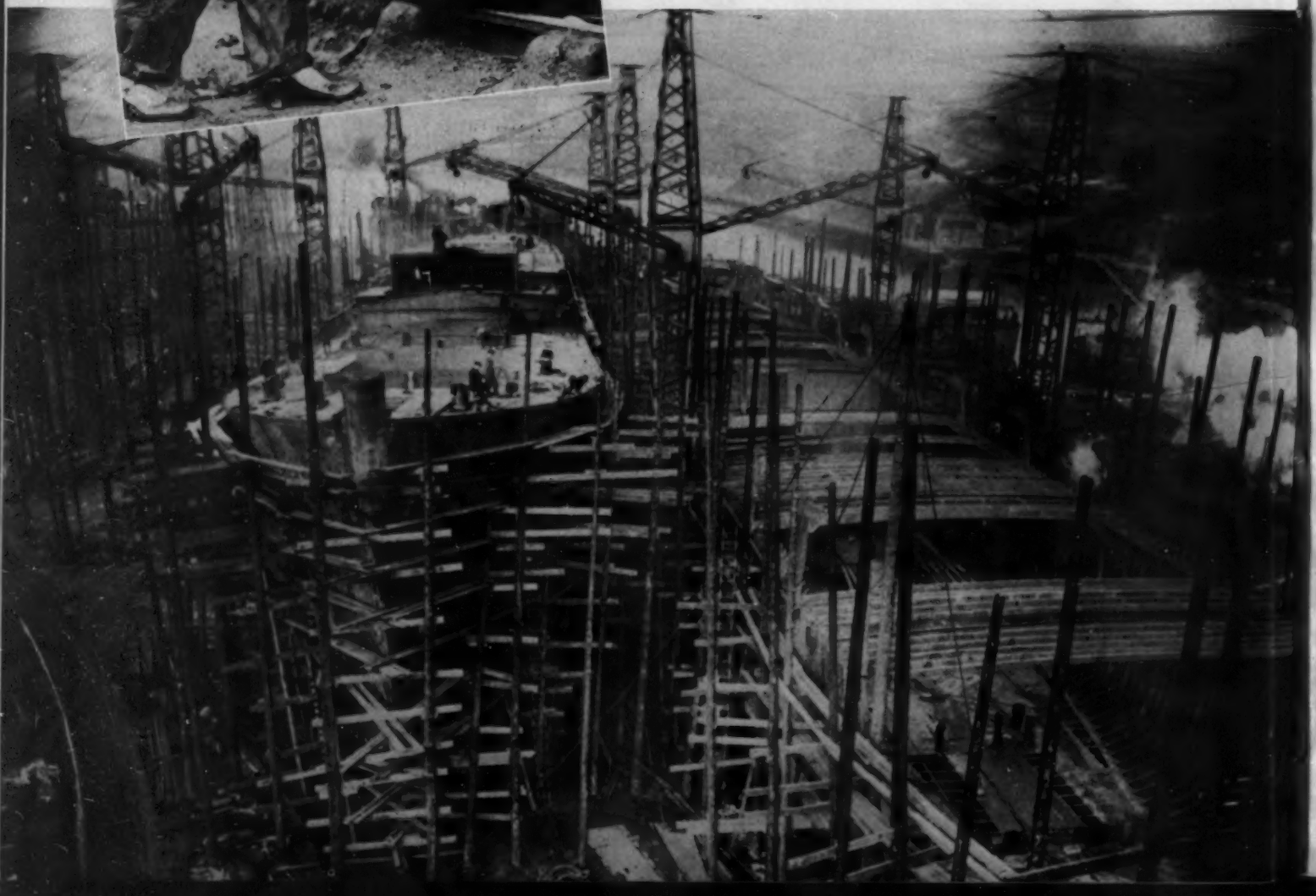
Gross tons—Scrap eliminated

	EXPORTS					IMPORTS				
	1941*	1940*	1939*	1938	1937	1941	1940	1939	1938	1937
United States	**6,337,673	7,785,540	2,499,220	2,149,000	3,472,000	**24,725	55,277	285,660	240,000	452,000
Great Britain				1,918,000	2,576,000				1,341,000	2,039,000
Germany				2,784,000	3,604,000				867,000	532,000
France				2,002,000	2,133,000				92,000	170,000
Belgium & Luxemburg				2,503,000	3,947,000				215,000	428,000
Total				11,356,000	15,732,000				2,755,000	3,621,000

*Export, import figures for 1939-1941, other than Western Hemisphere countries, not available, due to war; no figures available for 1942.
**Estimated.

Offensive war places heavier burden on BRITISH ST

By J. A. HORTON
British Correspondent, STEEL



STEEL MILLS

Fuel, manpower, raw materials major problems. . . Shipbuilding program exceeded. Abandoned yards recommissioned. . . . Welsh tin plate manufacture concentrated and many plants closed. . . Prices held stable and government subsidies offset increased costs

THE BRITISH steel industry is standing up to the strain and stress of war in a remarkable manner. Its resources have been harnessed to the colossal task of providing materials for an ever-growing army. At the end of three and a quarter years of war it can be said with confidence that it is delivering the goods in every sphere. Battle fronts are widening, especially now that the United Nations have taken the offensive, but thanks to the untiring efforts of the basic industries the essentials of modern warfare are available in growing quantities.

A year ago this writer drew attention to drastic changes which were being made in every producing district to bring about a bigger output of the steels most needed—high-speed steels and alloys. That process has gone on and adjustments will be made as the need arises. But other factors have come to the fore with the passing of another year, a year in which the United Nations have gradually passed from the defensive to the offensive. One of these is fuel. The seriousness of the coal situation had to be faced. Hence, the "Battle for Fuel" which Britain has been waging for months.

Along with the general public, industrial firms have been asked to help in this campaign. The reports received by the Ministry of Fuel's efficiency committee on the work of its regional panels of engineers who are visiting factories throughout the country show encouraging results. In one industrial area it was found that without any major alteration of the plant a saving of 10 per cent was possible. While industry in general probably could not effect so large an economy, even greater savings have been made in some individual cases. Iron and Steel Industries Research Council has reported that substantial economies, in most cases at least 10 per cent, will follow the appointment of fuel officers definitely responsible for fuel control. With the iron and steel industry so large a consumer of coal, economy such as this illustrates vividly the thoroughgoing manner in which manufacturers face new problems as they arise. Latest reports indicate that the fuel situation is better than could possibly have been anticipated a few months ago when the campaign started.

Manpower Problem Acute

Manpower is a greater problem than ever throughout the industry. During the last 12 months a big "comb-out" has taken place. A de-reservation of many men under 30 is in progress. There appears to be no alternative to further recruitment of women labor. For many of the jobs in the industry only women of strong physique are qualified, and so many of the younger women have been drafted into the services that the problem is not going to be easily solved. Before the war the thought of using women in iron and steel production would have evoked a smile. Today they constitute 1½ per cent of the total number employed in such plants, and they do 950 different tasks. They work at blast furnaces, unload steel turnings and scrap, load slag, hook scrap pans on to crane chains and guide them on to bogies. In the stockyards they sort and load scrap and cut it into lengths.

Concentration in iron foundries is under way and has been the subject of prolonged negotiations. The Board of Trade undertook the task and divided the country into regions. Full use is being made of existing machinery as far as trade organization is concerned to discuss plans suitable for each region. The broad idea behind them is that certain concerns shall shut down and their work be taken over by other concerns. Any surplus labor thus

Scarcity of manpower in the United Kingdom caused some railroads to hire women in operational jobs. At left above, a wiper works on a locomotive in a London yard. Center above, crew of an American bomber talks over a raid just completed on Axis territory. Right above, American built half-tracs pull heavy guns up to the Russian front. Left, two 10,000 ton cargo vessels under construction in an unnamed English port

released is then drafted to the most important work.

The policy of stabilization of prices has been strictly adhered to and no major change in values of the principal products has been made during the past year. Increases in steelworkers' wages have been announced in the North East. They apply to more than 20,000 workers. This is a substantial addition to producers' costs, but there is no effect on selling prices because the government has found other ways of compensating producers.

The industry takes its share in the outstanding progress which has taken place in the shipbuilding industry. The program has been exceeded. In the first six months of 1942 all arrears were cleared off and output has never been higher. Some interesting information regarding shipyards declared redundant by the National Shipbuilders Security some years ago has recently been made public. Of these yards, 11 are in use for building or repairing various types of craft, including vessels of over 10,000 tons deadweight. In addition 12 yards which closed between the two wars but with which National Shipbuilders Security was not concerned are also engaged in building and repair work.

The policy of the Admiralty is to reopen suitable yards when there is labor to man them. In pursuance of this policy one further yard is in process of being recommissioned and the reopening of another is under consideration. In the last 18 months thousands of men have been transferred from other industries to the shipyards and other men now are being examined.

While production has increased in all shipyards, maximum output has not yet been reached. Steelmakers have responded to the call for material in no uncertain manner. Mills making heavy steel plates have been full up with orders for months. Not only are they making plates for ships but for freight cars and locomotives, buildings and vehicles for army use.

In Scotland the outstanding feature of the steel trade is the heavy production of shipbuilding material, especially ship plates. The urgency of the demand from the shipyards for that and other material may be taken as a measure of rapid production of new shipping tonnage on the Clyde and other shipbuilding centers. The demand on the steelworks for plates, however, overshadows all other orders and manufacturers are understood to have sufficient work on hand to keep their platemaking plants busy for months ahead, even if no new orders are booked.

Structural Steel Under Tight Control

Many structural engineering firms have changed over to war work. There was a comparatively quiet phase at the beginning of 1942 among some contractors still exclusively interested in building work but this soon gave way to a more active period, partly due to the program of erection of camps and airfields to house American troops. Their activity now is restricted by the inability to get steel in sufficient quantity owing to the tight control exercised by the Ministry of Supply and the Ministry of Aircraft production.

The war has had a disturbing effect upon the Welsh tin plate trade, a trade which for many years contributed largely to the prosperity of the region and in no small way to the export trade of the United Kingdom. Virtually, tin plate production has been concentrated and is now shared

Many sections of Stalingrad were reduced to rubble by German bombers and artillery fire. Here is a typical scene, with two Russian women emerging from an underground shelter after an all-night pound by Nazi planes. NEA photo

between the cold strip plant, erected a few years ago, which is working to capacity, and a selected number of the ordinary hot mills. Of the latter, about 480 are in existence, but only about 160 are working, the remainder having been closed down and in some instances taken over by the government for other purposes.

Opinions differ on the effect of the changes, but there is general agreement that they are bound to be far reaching. On the one hand it is contended that the trade will never again regain its peacetime volume, that most of the hot mills will never be reopened, and that the former centers of the industry will gradually be de-populated. Others maintain that after the war the demand for tin plate from the war-ravaged countries and the leeway of demand in the Empire will be so great that the industry will be fully employed for five years. This opinion is based on the assumption that special financial arrangements will be made to promote international trade either under the terms of the Atlantic Charter or by an Anglo-American agreement.

The important part that scrap is playing in winning the war has been stressed by the British government many times during the last 12 months. One of the reasons for increasing supplies of scrap was the loss of imported iron ore. In the early part of the war it is known that more than 500,000 tons of scrap were imported from the United States. It is no longer possible to import scrap but, thanks to the domestic drive, large quantities have been brought

forward and stocks are maintained at a high level, higher indeed than in pre-war days. The Ministry of Works and Planning has requisitioned iron railings and fences from many parts of the country. Through these campaigns the deficiency of imported supplies has been largely met, but to some extent in a variety which is less suitable for the maintenance of peak outputs than that which was imported previously.

The gap between the normal collections of scrap and the present consumption is being made good by scrap of a capital nature which it is hoped will last for a considerable period but which must come to an end or at least be limited in supply at some future date. The policy of the control is to create a series of dumps throughout the country which can provide a reserve. The lighter kinds of scrap are in excess of demand. For a long time merchants have found themselves with an excess of turnings.

The pig iron situation has not altered materially. Without figures it is impossible to compare outputs but it is safe to say that production has again been on a record level. For some time hematite iron has been scarce but users have been able to find substitutes and many firms are using specifications which are different from those they used before the war. Most of the iron produced is high in phosphorus owing to the vastly increased use of native ore instead of imported ore.

The greatest economy has to be exercised in the use of low-phosphorus iron, the supply of which falls short of current needs. There is no basic iron to spare for the open market. It goes into immediate consumption in producers' own steelmaking plants.

The heavy engineering foundries are all engaged on work of national importance and are assured of full activity for many months. This work involves the use of extensive tonnages of medium-phosphorus pig iron, refined iron and steel scrap in place of hematite.

Although Britain imported heavy tonnages of semi-finished steel from the Continent before the war there has been no shortage of this material. Losses have been made up by increased output in British mills, and to some extent by production in the Dominions. In this department, as in some other industries, Britain has become largely self-supporting.

Britain Asks—What Price Liberty?

(*Continued from Page* 357)

tion to the work being done, even if it is of an essential nature licenses must be obtained to expand plant or install new machinery. Orders can only be taken under license or against receipt of special forms issued by government supply departments that give out contracts. Prices of staple manufactured products are fixed, while large government contracts are "costed" and priced under control of official auditors.

Ordinary relations between manufacturers and customers are destroyed, either through interposition of a central control, or a marketing board or some similar body, or through forced amalgamation of firms by concentration or otherwise.

It is almost impossible to start a new business. Old established firms may have no alternative but to close, with compensation not ensured in every case.

All profits above a prewar standard go to the Treasury in the form of 100 per cent excess profit tax, of which 20 per cent is credited to the undertaking for repayment some time after the war to help during the period of transition.

Labor Also Loses Privileges

Labor also has forsaken a considerable part of its freedom. Apart from conscription, which takes all men of military age for service in the forces, men and women work long hours and overtime as well; they cannot give up their jobs as and when they like; strikes cannot be declared unless a trade dispute has been reported to the minister of labor, then arbitration must be resorted to and eventually certain rules must be complied with. Labor can now be "diluted." "Mobile" workers may, in certain cases, be transferred from one factory to another, or even from one part of the country to another.

On the other hand, the government has undertaken to re-establish the rights acquired in past years by the trades unions when the war is over. Furthermore, workers have received substantial increases in wages. According to a statement made in Parliament in late October in a debate on the fixing of wages, the general average of earnings showed an increase of 46 per cent over the level prevailing in October, 1938. The Minister of Labor took a definite

(*Please turn to Page* 391)

DOMESTIC MARKET SUMMARY

All production records broken. . . Government control tightened and civilian uses curtailed. . . Short scrap supply hampers output. . . . Prices held at OPA ceilings. . Distribution greatest problem

ACCOMPLISHMENTS by the steel industry in 1942, the first full year of war, dwarfed all previous records in production and far surpassed the effort of 1941, which had been hailed as a high mark.

Government control continued and was tightened progressively in the effort to match output to war demand. Civilian supply was steadily reduced and use for other than war production was practically eliminated. Various plans were put into effect through the year and at the close the situation was much improved, supply being well matched with essential requirements.

At the beginning of 1942 it was believed the capacity of industry in general for production of ships, tanks, guns and other war needs would not be sufficient to absorb all the steel that could be made. However, phenomenal speed of conversion from civilian to wartime production provided facilities to use every ton of steel from greatly enlarged steelmaking capacity and call for more.

Office of Production Management, which had headed the government control machinery in the latter part of 1941, was succeeded in January by the War Production Board, which continued to function through the year. Taking counsel from the best minds in the steel industry, plans were adopted to equalize available steel with most essential demand, changes being made when they failed to meet conditions.

First of these was the Production Requirements Plan, under which consumers of war goods filed statements of their needs, accompanied by detailed account of the purposes for which the steel was destined. Priorities then were assigned and when these failed to cover the situation, directive were issued, taking precedence. This plan was announced late in March, to be effective July 1 and in full control for third quarter.

Weaknesses in this plan resulted in the Controlled Materials Plan being announced at the beginning of November. Its purpose was to avoid priority congestion in the upper brackets by taking stock of total production and issuing priorities for no more tonnage that could be provided, thus matching demand to supply. Donald M. Nelson, head of WPB denominated this as the "most important thing WPB has done to insure that first things come first" in the war effort. One effect of this order was to cause cancellation of large tonnages in steel mill backlogs as there remained no point to retaining orders for distant delivery. Much is expected of this plan in relieving burden on steelmakers, the market being reduced practically to current demand.

Glut of A-1-a Ratings Forces Directives

Under conditions existing early in the year priorities were issued to an extent that by March great congestion developed in the upper brackets and a high proportion of orders were on A-1-a ratings. By mid-April delivery promises below A-1 were practically impossible. By the end of April A-1-a priority was so common it meant little and only directives were effective in obtaining delivery.

Early in July the Director of Industry Operations issued new priority regulations, superposing designations of AAA, AA-1, AA-2 and so on, all taking precedence over A-1-a. This was followed by a rush of rerating on old orders. Need for this change was indicated by the fact that many mills has 80 to 90 per cent of their orders on directives. By September the situation became as bad as before the change and directives again were almost the only means of obtaining steel. To correct this condition Controlled Materials Plan was devised and put into effect.

At a means of equalizing supplies with demand, WPB used various expedients. An order froze all inventories of surplus steel, which could be sold only under direct orders, to make best use for war purposes. At the end of May a list of more than 400 civilian articles was issued, manufacture of which was ordered stopped, to conserve steel for vital needs and July 19 was set as the deadline for production of parts for these goods. Inclusion of end-use symbols on PRP applications was made mandatory as of August 31.

Control was applied as far back as the ingot and raw steel was allocated to various finishing processes in proportion to needs. This produced an unbalanced condition with rolling mills, some departments operating at a low rate as their raw material was curtailed. Some non-integrated mills suffered from lack of steel and directives were needed to correct this situation. Even integrated mills frequently had insufficient semifinished for their own finishing departments. Added to this condition was allocation of large tonnages for lend-lease export, which

disrupted rolling schedules of semifinished producers, as they took precedence over priorities.

Heavy demand for steel plates for shipbuilding, tank construction and other essential purposes led to conversion of sheet and strip continuous mills to production of lighter gages of plates, leaving universal and sheared plate mills to concentrate on heavier material. The result of this was to enlarge plate capacity to practically double and the converted mills at times produced practically half the tonnage.

Plate Distribution Most Efficient

Inventories of plate users were scanned and accumulations were prevented, thus avoiding an unbalanced condition. The plate situation was so well handled that before the end of the year it was found possible to use less than capacity to provide sufficient for all needs. In May plate mills supplied 1,012,195 tons, of which continuous mills contributed 425,211 tons. In June output reached 1,124,118 tons. With capacity reliably estimated at 1,250,000 tons production in last half was held at about 1,100,000 tons monthly.

In late September steel bars became the tightest product, especially in rounds and flats over 1½ inches. Efforts were made to roll large rounds on structural and rail mills but difficulty was encountered in holding tolerances on these mills. Alloy bars were more difficult to obtain than plain carbon and deliveries at the end of the year were extended far into 1943. The latter condition was general in all alloy products, due in part to lack of sufficient alloying elements.

Restrictions on tin plate production were imposed as early as February, to conserve tin and also to limit steel for this use. Several electrolytic tin plating lines were installed, a thinner coating being possible than by the conventional hot-dip process. It developed that these installations were practically sufficient to provide all the tin plate allowed to be used. To enlarge supply of tin several detinning plants were ordered erected in strategic locations and a campaign was carried on for recovery of used tin-plated cans, householders in cities preparing them for regular collections. After recovery of the tin the remaining steel sheets were baled for steel scrap.

One of the difficult situations was shortage of steelmaking scrap, which prevailed over most of the year. From the beginning this was apparent, winter having reduced supplies to a point where open hearths were not fully supplied and frequently were idle.

Various efforts were made to increase supply, the high

(*Please turn to Page* 392)

Pig Iron and Steel Ingot Production

Steel Ingot Figures by American Iron and Steel Institute. Coke Pig Iron by STEEL

Pig Iron Production

Net Tons

	Stacks No.	Stacks In	Output Total	Output Av. daily	Stacks No.	Stacks In	Output Total	Output Av. daily	Stacks No.	Stacks In	Output Total	Output Av. daily	Stacks No.	Stacks In	Output Total	Output Av. daily
			1929				1936				1937				1938	
Jan.	328	202	3,844,991	124,031	267	118	2,272,820	73,316	243	169	3,606,110	116,327	236	91	1,618,245	52,201
Feb.	326	208	3,604,581	128,735	266	120	2,059,604	71,020	242	176	3,382,407	120,800	236	91	1,463,093	52,254
March	326	213	4,154,660	134,021	265	126	2,291,656	73,924	242	182	3,886,926	125,385	236	90	1,646,636	53,117
April	326	216	4,102,747	136,759	265	143	2,698,611	89,954	241	186	3,808,712	126,956	236	79	1,554,569	51,819
May	325	220	4,366,145	140,843	253	145	2,978,800	96,096	240	170	3,970,602	128,083	236	73	1,412,249	45,556
June	325	220	4,160,917	138,697	253	144	2,908,111	96,937	240	182	3,489,138	116,304	236	67	1,188,037	39,601
July	325	217	4,236,412	136,658	252	146	2,907,286	93,783	237	192	3,921,522	126,501	236	77	1,358,645	43,827
Aug.	325	209	4,196,742	135,346	248	148	3,037,133	97,972	237	191	4,050,989	130,677	237	88	1,674,976	54,031
Sept.	323	204	3,916,029	130,534	247	154	3,055,648	101,855	237	181	3,828,115	127,604	237	97	1,885,069	62,835
Oct.	318	203	4,018,724	129,637	245	161	3,350,809	108,090	237	151	3,237,949	104,450	237	114	2,315,599	74,697
Nov.	317	176	3,564,310	118,811	245	165	3,303,935	110,131	237	114	2,247,875	74,929	236	121	2,561,060	85,369
Dec.	316	156	3,177,347	102,495	245	170	3,500,215	112,911	237	93	1,683,891	54,319	236	115	2,478,244	79,943
Total			47,342,605	*129,705			34,364,628	*93,892			41,114,236	*112,642			21,156,422	*57,962
			1939				1940				1941				**1942	
Jan.	237	118	2,436,474	78,596	233	177	4,024,556	129,825	229	205	4,666,233	150,524	...	...	4,983,229	.....
Feb.	237	121	2,307,405	82,407	233	157	3,304,368	113,943	229	202	4,206,826	150,244	...	...	4,454,590	.....
March	237	123	2,680,446	86,465	233	152	3,270,575	105,502	229	205	4,702,905	151,707	...	...	4,989,932	.....
April	236	102	2,301,965	76,732	233	155	3,139,043	104,635	229	191	4,340,555	144,685	...	...	4,836,786	.....
May	236	106	1,923,625	62,052	233	171	3,497,157	112,811	229	206	4,596,113	148,262	...	...	5,025,127	.....
June	235	117	2,373,753	79,125	232	181	3,813,092	127,103	229	211	4,551,040	151,701	...	...	4,890,125	.....
July	235	129	2,638,760	85,121	231	187	4,060,513	130,984	229	212	4,766,216	153,749	...	...	4,997,670	.....
Aug.	235	138	2,979,774	96,122	231	190	4,234,576	136,599	229	215	4,784,639	154,343	...	...	4,995,071	.....
Sept.	235	169	3,218,940	107,298	231	192	4,172,551	139,085	230	219	4,721,337	157,378	...	...	4,889,911	.....
Oct.	235	188	4,062,670	131,053	231	196	4,437,725	143,152	230	216	4,860,033	156,775	...	...	5,165,012	.....
Nov.	235	191	4,166,512	138,883	231	202	4,397,656	146,589	231	217	4,707,194	156,906	...	...	.....	.....
Dec.	233	191	4,219,718	136,119	231	202	4,542,864	146,544	232	218	5,014,995	161,774	...	...	.....	.....
Total			35,310,042	*96,740			46,894,676	*128,128			55,918,086	153,200			†49,665,163	.....

*Average. †Eleven months. **Figures by American Iron and Steel Institute. †Ten months.

Steel Ingot Production and Operating Rates

Net Tons

	1929 Total	1929 Weekly Av.	1929 % of Capacity	1936 Total	1936 Weekly Av.	1936 % of Capacity	1937 Total	1937 Weekly Av.	1937 % of Capacity	1938 Total	1938 Weekly Av.	1938 % of Capacity
Jan.	5,040,147	1,137,731	86.84	3,404,581	768,528	52.39	5,284,648	1,192,923	81.32	1,942,265	438,434	29.17
Feb.	4,848,159	1,212,039	92.51	3,311,718	799,932	54.53	4,944,463	1,236,116	84.27	1,901,146	475,287	31.63
March	5,676,357	1,281,345	97.80	3,733,915	842,871	57.46	5,844,525	1,319,306	89.94	2,244,708	506,706	33.72
April	5,544,059	1,292,322	98.64	4,404,518	1,024,344	69.99	5,679,371	1,323,862	90.25	2,149,327	501,008	33.34
May	5,920,596	1,336,478	102.01	4,521,860	1,020,736	69.58	5,770,138	1,302,514	88.79	2,016,982	455,301	30.30
June	5,491,310	1,280,026	97.70	4,452,637	1,037,911	70.75	4,686,890	1,092,515	74.48	1,828,784	426,290	28.36
July	5,432,653	1,229,107	93.82	4,384,094	991,876	67.61	5,103,060	1,154,539	78.48	2,211,235	500,279	33.29
Aug.	5,531,776	1,247,708	95.31	4,686,401	1,057,878	72.11	5,463,165	1,233,220	83.83	2,841,554	641,434	42.68
Sept.	5,071,233	1,184,868	90.44	4,649,555	1,086,344	74.05	4,804,248	1,122,488	76.30	2,964,785	692,707	46.09
Oct.	5,078,445	1,146,376	87.50	5,078,356	1,146,356	78.15	3,800,075	857,805	58.31	3,478,703	785,260	52.25
Nov.	3,943,644	919,265	70.17	4,841,788	1,128,622	76.94	2,412,889	562,445	38.28	3,985,367	928,990	61.81
Dec.	3,251,373	735,663	56.15	4,955,291	1,121,107	76.42	1,649,784	373,255	25.37	3,506,436	793,312	52.79
Total	60,829,752	1,166,661	89.05	52,424,714	1,002,768	68.36	55,443,256	1,063,354	72.38	31,071,292	595,921	39.65

	1939 Total	1939 Weekly Av.	1939 % of Capacity	1940 Total	1940 Weekly Av.	1940 % of Capacity	1941 Total	1941 Weekly Av.	1941 % of Capacity	1942 Total	1942 Weekly Av.	1942 % of Capacity
Jan.	3,578,863	807,870	52.83	5,764,723	1,301,292	83.4	6,922,352	1,562,608	96.8	7,124,922	1,608,335	94.7
Feb.	3,368,915	842,229	55.07	4,525,797	1,093,188	70.0	6,230,354	1,557,589	96.5	6,521,056	1,630,264	96.0
March	3,839,127	866,620	56.67	4,389,183	990,786	63.5	7,124,003	1,608,127	99.6	7,392,911	1,668,829	98.2
April	3,352,774	781,532	51.11	4,100,474	955,821	61.2	6,754,179	1,574,401	97.6	7,122,313	1,660,213	97.7
May	3,295,164	743,829	48.64	4,967,782	1,121,395	71.8	7,044,565	1,590,195	98.5	7,386,890	1,667,470	98.2
June	3,523,880	821,417	53.71	5,657,443	1,318,751	84.5	6,792,751	1,583,392	98.1	7,022,155	1,636,866	96.4
July	3,564,827	806,522	52.74	5,724,625	1,295,164	83.0	6,812,224	1,541,227	93.3	7,148,824	1,617,381	94.5
Aug.	4,241,994	957,561	62.62	6,186,383	1,396,475	89.5	6,997,494	1,579,570	95.6	7,233,451	1,632,833	95.4
Sept.	4,769,468	1,114,362	72.87	6,056,246	1,415,011	90.6	6,811,754	1,591,531	96.3	7,067,084	1,651,188	96.5
Oct.	6,080,177	1,372,500	89.75	6,644,542	1,499,897	96.1	7,236,068	1,633,424	98.9	7,584,864	1,712,159	100.1
Nov.	6,147,783	1,433,050	93.71	6,469,107	1,507,950	96.6	6,960,885	1,622,584	98.2	7,184,560	1,674,723	97.9
Dec.	5,822,014	1,317,198	86.13	6,495,357	1,469,538	94.1	7,150,315	1,617,718	97.9	.....	.....	...
Total	51,584,986	989,355	64.70	**66,981,662	1,281,210	82.1	**82,836,946	1,588,741	97.3	†78,789,030	*1,651,069	96.7

Compiled by American Iron and Steel Institute. †Beginning with 1927 the Institute excludes crucible and electric ingots, which totaled 756,138 net tons in 1927, 907,232 tons in 1928, 1,073,045 tons in 1929, 688,634 tons in 1930, 461,987 tons in 1931, 270,766 tons in 1932, 47,510 tons in 1933, 405,246 tons in 1934, 607,190 tons in 1935, 866,063 tons in 1936, 913,073 tons in 1937, 524,850 tons in 1938, 952,453 tons in 1939. **Includes electric steel ingots and steel castings. Crucible steel in 1940 was 1024 tons; in 1941 it was 2313 tons. †Eleven months. *Average.

Average Monthly Quotations in 1942

Base or Furnace, Unless Otherwise Specified; Scrap, Delivered to Consumers

PITTSBURGH

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Structural Shapes	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c
Plates	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
Bars	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15
Cold-Finished Steel Bars	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65
Strip, Hot-Rolled	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
Strip, Cold-Rolled	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80
Standard Spikes	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Plain Wire	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60
Structural Rivets	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
Hot Rolled Sheets	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
No. 24 Galvanized Sheets	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
Tin Plate, base box	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Wire Nails	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55
Steel Pipe, 1 to 3-inch, % discount (base $200 per ton)	68 ½%	68 ½%	68 ½%	68 ½%	68 ½%	68 ½%	68 ½%	68 ½%	68 ½%	68 ½%	68 ½%	68 ½%
Bessemer Pig Iron, Neville Island base	$24.50	$24.50	$24.50	$24.50	$24.50	$24.50	$24.50	$24.50	$24.50	$24.50	$24.50	$24.50
Basic Pig Iron, Neville Island base	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50
No. 2 Foundry Pig Iron, Neville Island Base	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
Malleable Pig Iron, Neville Island Base	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
Bessemer Ferrosilicon, 10 per cent (Jackson co. base)	37.50	37.50	37.50	37.50	37.50	37.50	37.50	37.50	37.50	37.50	37.50	37.50
Billets, Bessemer and Open-Hearth	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00
Sheet Bars, Bessemer and Open-Hearth	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00
Wire Rods	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Furnace Coke, spot	6.20	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Foundry Coke, spot	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25
Heavy Melting Steel Scrap	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
Low Phosphorus Scrap	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00
No. 1 Cast Scrap	20.55	20.55	20.55	20.55	20.55	20.55	20.55	20.55	20.55	20.55	20.55	20.55

CHICAGO

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Bars	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c
Plates	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
Structural Shapes	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
Rail Steel Bars	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15
Cold Rolled Sheets	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05
No. 2 Foundry and Malleable Pig Iron	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00
Lake Superior Charcoal Iron, Delivered Chicago	31.34	31.34	31.44	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54
Heavy Melting Steel Scrap	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75
Rails for Rolling	22.25	22.25	22.25	22.25	22.25	22.25	22.25	22.25	22.25	22.25	22.25	22.25
No. 1 Machinery Cast Scrap	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00

EASTERN PENNSYLVANIA

Tank Plates, delivered Philadelphia	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c
Structural Shapes, delivered Philadelphia	2.21	2.21	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22
Steel Bars, delivered Philadelphia	2.47	2.47	2.48	2.49	2.49	2.49	2.49	2.49	2.49	2.49	2.49	2.49
Hot Rolled Sheets, delivered Philadelphia	2.27	2.27	2.27	2.28	2.28	2.28	2.28	2.28	2.28	2.28	2.28	2.28
Basic Pig Iron, delivered	$25.34	$25.34	$25.36	$25.39	$25.39	$25.39	$25.39	$25.39	$25.39	$25.39	$25.39	$25.39
No. 2X Foundry Pig Iron, delivered Philadelphia	26.21	26.21	26.24	26.26	26.26	26.26	26.26	26.26	26.26	26.26	26.26	26.26
Standard Low Phosphorus Pig Iron, delivered	30.74	30.74	30.77	30.81	30.81	30.81	30.81	30.81	30.81	30.81	30.81	30.81
No. 1 Heavy Melting Scrap	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75
No. 1 Cupola Cast Scrap	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
Spiegeleisen, 20%	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00
Ferromanganese, delivered Pittsburgh	125.33	125.33	125.33	125.33	140.65	140.65	140.65	140.65	140.65	140.65	140.65	140.65

COAL TAR PRODUCTS

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Benzol, per gallon producers' plants, tank lots	15.00c	15.00c	15.00c	15.00c	15.00c	15.00c	15.00c	15.00c	15.00c	15.00c	15.00c	15.00c
Toluol, two degree, per gallon producers' plants, tank lots	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00
Solvent naphtha, per gallon producers' plants, tank lots	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00
Xylol, per gallon, producers' plants, tank lots	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00
Napthalene, flakes and balls, per pound, producers' plants	7.00	7.50	7.50	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
Phenol, per pound, producers' plants, 1000 pounds or less	14.75	14.75	14.25	13.25	13.25	13.25	13.25	13.25	13.25	13.25	13.25	13.25
Sulphate of ammonia, per ton bulk f.o.b. Atlantic seaboard	$29.20	$29.20	$29.20	$29.20	$29.20	$29.20	$29.20	$29.20	$29.20	$29.20	$29.20	$29.20

NONFERROUS METALS

Prompt wholesale prices in cents per pound

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Tin Straits, spot, New York	52.000	52.000	52.000	52.000	52.000	52.000	52.000	52.000	52.000	52.000	52.000	52.000
Copper, electrolytic, delivered, Connecticut	12.000	12.000	12.000	12.000	12.000	12.000	12.000	12.000	12.000	12.000	12.000	12.000
Zinc, prime western, East St. Louis	8.250	8.250	8.250	8.250	8.250	8.250	8.250	8.250	8.250	8.250	8.250	8.250
Lead, open market, East St. Louis	6.125	6.350	6.350	6.350	6.350	6.350	6.350	6.350	6.350	6.350	6.350	6.350
Lead, open market, New York	6.275	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500
Aluminum, ninety-nine per cent plus	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000
Antimony, American*	14.000	14.000	14.154	14.500	14.500	14.500	14.500	14.500	14.500	14.500	14.500	14.500
Nickel, cathodes	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000

*January and February, spot, New York; subsequent months, f.o.b. smelter.

Monthly Price Averages for Twelve Years

Prices Averages for Years Prior to 1932 may be found in STEEL for January 7, 1935

ORES AND ALLOYS

Per Gross Ton

Iron Ore Prices at Date of Buying Movement, Delivered Lower Lake Ports

Season	Date buying movement	Old range Bessemer Ton	Old range Bessemer Cents per unit	Old range Nonbessemer Ton	Old range Nonbessemer Cents per unit	Mesabi Bessemer Ton	Mesabi Bessemer Cents per unit	Mesabi Nonbessemer Ton	Mesabi Nonbessemer Cents per unit	Iron prices, Valley No. 2 Bessemer	Iron prices, Valley No. 2 Foundry
1942	Apr. 10, 1942	$4.75	9.223	$4.60	8.932	$4.60	8.932	$4.45	8.641	$24.00	$24.50
1941	Apr. 17, 1941	4.75	9.223	4.60	8.932	4.60	8.932	4.45	8.641	24.00	24.50
1940	Apr. 17, 1940*	4.75	9.223	4.60	8.932	4.60	8.932	4.45	8.641	23.50	23.00
1940	Jan. 2, 1940	5.25	10.194	5.10	9.903	5.10	9.903	4.95	9.612	23.50	23.00
1939	May 3, 1939	5.25	10.194	5.10	9.903	5.10	9.903	4.95	9.612	21.50	21.00
1938	May 23, 1938	5.25	10.194	5.10	9.903	5.10	9.903	4.95	9.612	24.50	24.00
1937	Mar. 12, 1937	5.25	10.194	5.10	9.903	5.10	9.903	4.95	9.612	24.50	24.00
1936	Apr. 3, 1936	4.80	9.320	4.65	9.029	4.65	9.029	4.50	8.738	20.00	19.50
1935	May 4, 1935	4.80	9.320	4.65	9.029	4.65	9.029	4.50	8.738	19.00	18.50
1934	May 19, 1934	4.80	9.320	4.65	9.029	4.65	9.029	4.50	8.738	19.00	18.50
1933	June 12, 1933	4.80	9.320	4.65	9.029	4.65	9.029	4.50	8.738	16.00	15.50
1932	June 3, 1932	4.80	9.320	4.65	9.029	4.65	9.029	4.50	8.738	14.50	14.50
1929	Mar. 22, 1929	4.80	9.320	4.65	9.029	4.65	9.029	4.50	8.738	18.50	18.00

*Price reduced.

Manganese Ore

Dollars Per Gross Ton, Duty Paid, Northern Atlantic Ports, on Basis of 50 Per Cent Ore

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1942	$40.10	$39.35	$38.60	$39.35	$40.10	$42.35	$52.10	$52.10	$52.10	$52.10	$44.28	$43.00
1941	33.03	34.85	35.60	40.10	40.10	41.60	41.60	41.60	40.85	40.10	40.10	40.10
1940	30.10	30.10	30.10	30.10	30.10	33.60	34.10	35.60	34.35	32.85	32.85	32.85
1939	20.85	20.85	20.35	20.10	20.10	20.10	20.10	20.10	Nom.	29.32	30.52	30.66
1938	28.10	28.10	28.10	28.10	28.10	28.10	25.60	25.60	25.60	22.60	21.10	21.60
1937	21.10	22.60	22.85	27.60	27.60	27.85	31.85	31.85	31.85	30.60	28.60	28.10
1936*	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	19.10	19.10	20.60
1935	23.70	23.70	23.70	23.70	23.70	23.70	23.70	23.70	23.70	23.70	23.70	23.70
1934	21.70	22.70	22.70	22.70	22.70	22.70	22.70	22.70	23.20	23.70	23.70	23.70
1933	19.95	19.95	19.95	19.95	19.95	20.20	20.45	21.45	21.45	21.70	21.70	21.70
1932	22.70	22.70	22.70	22.70	21.70	21.70	21.70	21.70	21.20	21.20	21.20	20.70
1929	27.70	27.70	27.70	27.70	27.70	27.70	26.70	26.70	26.70	25.70	25.70	25.70

*Effective Jan. 1, duty ½c per pound metallic content; $5.60 gross ton on 50 per cent ore.

Bessemer Ferrosilicon, 10 Per Cent

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1942	$37.50	$37.50	$37.50	$37.50	$37.50	$37.50	$37.50	$37.50	$37.50	$37.50	$37.50	$37.50
1941	34.00	34.00	34.00	34.00	34.00	34.00	37.50	37.50	37.50	37.50	37.50	37.50
1940	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00
1939	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	31.00	32.00	32.00	33.00
1938	33.00	33.00	33.00	33.00	33.00	33.00	29.00	29.00	29.00	30.00	30.00	30.00
1937	29.00	29.00	31.80	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00
1936	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75	29.00
1935	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75
1934	27.25	27.25	27.25	27.25	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75
1933	20.50	20.50	20.50	20.50	20.50	20.75	22.40	24.65	27.00	27.75	27.75	27.73
1932	23.00	22.00	20.50	20.50	20.50	20.50	20.50	20.50	20.50	20.50	20.50	20.50
1929	31.00	31.00	31.00	31.00	31.00	31.00	31.00	30.20	30.00	30.00	30.00	30.00

Ferrosilicon, 50 Per Cent

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1942	$74.50	$74.50	$74.50	$74.50	$74.50	$74.50	$74.50	$74.50	$74.50	$74.50	$74.50	$74.50
1941	74.50	74.50	74.50	74.50	74.50	74.50	74.50	74.50	74.50	74.50	74.50	74.50
1940	69.50	69.50	69.50	69.50	69.50	70.50	74.50	74.50	74.50	74.50	74.50	74.50
1939	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50
1938	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50
1937	69.50	69.50	69.50	69.50	69.50	69.50	69.30	69.50	69.50	69.50	69.50	69.50
1936	77.50	77.50	77.50	77.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50
1935	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50
1934	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50
1933	74.50	74.50	74.50	74.50	74.50	74.50	74.50	74.50	74.50	74.50	74.50	74.50
1932	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	76.30
1929	83.50	83.50	83.50	83.50	83.50	83.50	83.50	83.50	83.50	83.50	83.50	83.50

Spiegeleisen, 20 Per Cent

At Producers' Furnaces

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1942	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00
1941	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00
1940	32.00	32.00	32.00	32.00	32.00	34.40	36.00	36.00	36.00	36.00	36.00	36.00
1939	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	30.00	32.00	32.00	32.00
1938	33.00	33.00	33.00	33.00	33.00	33.00	28.00	28.00	28.00	28.00	28.00	28.00
1937	26.00	26.00	28.00	30.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00
1936	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00
1935	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00
1934	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00
1933	24.00	24.00	24.00	24.00	24.00	24.00	27.00	27.00	27.00	27.00	27.00	27.00
1932	27.00	27.00	27.00	27.00	27.00	26.50	25.00	25.00	25.00	25.00	24.25	24.00
1929	34.00	34.00	34.00	34.00	34.00	34.00	34.00	33.20	33.50	34.00	34.00	34.00

Ferromanganese, 80 Per Cent, del. Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1942	$125.33	$125.33	$125.33	$125.33	$140.65	$140.65	$140.65	$140.65	$140.65	$140.65	$140.65	$140.65
1941	125.33	125.33	125.33	125.33	125.33	125.33	125.33	125.33	125.33	125.33	125.33	125.33
1940	105.33	105.33	105.33	105.33	105.33	105.33	125.33	125.33	125.33	125.33	125.33	125.33
1939	91.58	85.33	85.33	85.33	85.33	85.33	85.33	85.33	95.33	105.33	105.33	105.33
1938	107.49	107.49	107.49	107.49	107.77	107.77	97.77	97.77	97.77	97.77	97.83	97.83
1937	84.79	84.79	92.29	99.79	107.29	107.29	107.29	107.29	107.29	107.29	107.39	107.49
1936*	90.13	80.13	80.13	80.13	80.13	80.13	80.13	80.13	80.13	80.13	80.13	82.65
1935	89.79	89.79	89.79	89.85	90.13	90.13	90.13	90.13	90.13	90.13	90.13	90.13
1934	90.24	90.24	90.24	90.24	90.24	90.00	89.79	89.79	89.79	89.79	89.79	89.79
1933	73.24	73.24	73.24	73.24	73.24	73.24	84.44	87.24	87.24	87.24	87.24	87.24
1932	79.85	80.24	80.24	80.24	80.24	74.99	73.24	73.24	73.24	73.24	73.24	73.24
1929	109.79	109.79	109.79	109.79	109.79	109.79	109.79	109.79	109.79	109.79	109.79	104.79

*Duty of 1 cent per pound contained manganese became effective on ferromanganese Jan. 1, 1936.

PIG IRON

Per Gross Ton

Basic, Valley

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1942	$23.50	$23.50	$23.50	$23.50	$23.50	$23.50	$23.50	$23.50	$23.50	$23.50	$23.50	$23.50
1941	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50
1940	22.50	22.50	22.50	22.50	22.50	22.50	22.50	22.50	22.50	22.50	22.50	23.00
1939	20.50	20.50	20.50	20.50	20.50	20.50	20.50	20.50	21.50	22.50	22.50	22.50
1938	23.50	23.50	23.50	23.50	23.50	23.50	19.50	19.50	19.50	20.50	20.50	20.50
1937	20.50	20.50	23.10	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50
1936	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.25	20.00
1935	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	19.00	19.00
1934	17.00	17.00	17.00	17.60	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00
1933	14.00	14.00	14.00	14.00	14.40	15.00	15.60	16.00	17.00	17.00	17.00	17.00
1932	15.00	15.00	15.00	15.00	15.00	14.50	14.00	14.00	14.00	14.00	14.00	14.00
1929	17.50	17.50	17.60	18.00	18.30	18.50	18.50	18.50	18.50	18.50	18.50	18.50

Basic, delivered Eastern Pennsylvania

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1942	$25.34	$25.34	$25.36	$25.39	$25.39	$25.39	$25.39	$25.39	$25.39	$25.39	$25.39	$25.39
1941	25.34	25.34	25.34	25.34	25.34	25.34	25.34	25.34	25.34	25.34	25.34	25.34
1940	24.34	24.34	24.34	24.34	24.34	24.34	24.34	24.34	24.34	24.34	24.34	24.84
1939	22.34	22.34	22.34	22.34	22.34	22.34	22.34	22.34	23.54	24.34	24.34	24.34
1938	25.34	25.34	25.34	25.34	25.34	24.69	21.34	21.34	21.34	22.34	22.34	22.34
1937	22.26	22.51	24.76	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26
1936	20.81	20.81	20.81	20.81	20.81	20.81	20.81	20.81	20.81	20.81	21.06	21.81
1935	19.76	19.76	19.76	19.76	19.81	19.81	19.81	19.81	19.81	19.81	20.81	20.81
1934	18.76	18.76	18.76	19.51	19.76	19.76	19.76	19.76	19.76	19.76	19.76	19.76
1933	13.50	13.50	13.50	14.19	15.99	18.19	16.79	17.20	17.76	17.76	17.76	18.76
1932	16.00	15.75	15.75	15.00	15.00	14.50	14.35	13.90	13.75	13.60	13.50	13.50
1929	20.15	20.50	20.25	20.25	20.50	20.25	19.85	19.85	19.85	19.75	19.75	19.75

No. 2 Foundry, f.o.b. Chicago

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1942	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00
1941	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
1940	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.50
1939	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	22.20	23.00	23.00	23.00
1938	24.00	24.00	24.00	24.00	24.00	24.00	20.00	20.00	20.00	21.00	21.00	21.00
1937	21.00	21.00	23.20	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
1936	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.75	20.50
1935	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.75	19.50	19.50
1934	17.50	17.50	17.50	18.25	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50
1933	15.50	15.50	15.50	15.50	15.90	16.00	16.75	17.00	17.50	17.50	17.50	17.50
1932	16.50	16.50	16.50	16.00	15.60	16.00	15.50	15.50	15.50	15.50	15.50	15.50
1929	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00

No. 2X Foundry, delivered Philadelphia

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1942	$26.21	$26.21	$26.23	$26.26	$26.26	$26.26	$26.26	$26.26	$26.26	$26.26	$26.26	$26.26
1941	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21
1940	25.21	25.21	25.21	25.21	25.21	25.21	25.21	25.21	25.21	25.21	25.21	25.71
1939	23.21	23.21	23.21	23.21	23.21	23.21	23.21	23.21	24.41	25.21	25.21	25.21
1938	26.21	26.21	26.21	26.21	26.21	26.21	22.21	22.21	22.21	23.21	23.21	23.21
1937	23.14	23.39	25.64	26.14	26.14	26.14	26.14	26.14	26.14	26.14	26.14	26.14
1936	21.68	21.68	21.68	21.68	21.68	21.68	21.68	21.68	21.68	21.68	21.93	22.68
1935	20.63	20.63	20.63	20.63	20.68	20.68	20.68	20.68	20.68	20.68	21.68	21.68
1934	19.63	19.63	19.63	20.38	20.63	20.63	20.63	20.63	20.63	20.63	20.63	20.63
1933	13.76	13.76	13.76	14.51	15.91	16.76	17.28	17.88	18.63	18.63	18.63	19.63
1932	15.76	15.76	15.76	15.66	15.13	14.76	14.76	14.51	14.26	14.16	13.95	13.88
1929	22.26	22.01	22.26	22.26	22.76	22.76	22.76	22.26	22.26	22.26	22.26	21.76

No. 2X Foundry, f.o.b. Buffalo

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1942	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00
1941	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
1940	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.50
1939	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	22.50	23.00	23.00	23.00
1938	24.00	24.00	24.00	24.00	24.00	24.00	20.00	20.00	20.00	21.00	21.00	21.00
1937	21.00	21.25	23.50	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
1936	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.75	19.75
1935	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	19.50	19.50
1934	17.50	17.50	17.50	18.25	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50
1933	16.50	16.50	16.50	16.50	16.50	16.50	17.10	17.75	17.50	17.50	17.50	17.50
1932	16.50	16.50	16.50	16.50	16.50	17.50	17.50	17.50	17.50	17.50	17.50	17.50
1929	19.00	19.00	19.25	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00

Southern No. 2, f.o.b. Birmingham

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1942	$20.38	$20.38	$20.38	$20.38	$20.38	$20.38	$20.38	$20.38	$20.38	$20.38	$20.38	$20.38
1941	20.38	20.38	20.38	20.38	20.38	20.38	20.38	20.38	20.38	20.38	20.38	20.38
1940	19.38	19.38	19.38	19.38	19.38	19.38	19.38	19.38	19.38	19.38	19.38	19.88
1939	17.38	17.38	17.38	17.38	17.38	17.38	17.38	17.38	18.58	19.38	19.38	19.38
1938	20.38	20.38	20.38	20.38	20.38	20.38	16.38	16.38	16.38	17.38	17.38	17.38
1937	17.38	17.63	19.88	20.38	20.38	20.38	20.38	20.38	20.38	20.38	20.38	20.38
1936	15.50	15.50	15.50	15.50	15.50	15.50	15.50	15.50	15.50	15.50	15.84	15.75
1935	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.75	15.50
1934	13.50	13.50	13.50	14.25	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50
1933	11.00	11.00	11.00	11.40	12.00	12.00	12.60	13.00	13.50	13.50	13.50	13.50
1932	12.00	11.20	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00
1929	16.50	16.50	16.50	15.50	15.50	15.25	14.00	14.00	14.00	14.00	14.00	14.00

Malleable, f.o.b. Valley

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1942	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00
1941	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
1940	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.50
1939	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	22.00	23.00	23.00	23.00
1938	24.00	24.00	24.00	24.00	24.00	24.00	20.00	20.00	20.00	21.00	21.00	21.00
1937	21.00	21.00	23.60	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
1936	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.75	20.50
1935	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	19.50	19.50
1934	17.50	17.50	17.50	18.10	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50
1933	14.50	14.50	14.50	14.50	14.90	15.50	16.10	16.50	17.50	17.50	17.50	17.50
1932	16.00	15.50	15.50	15.50	15.00	14.50	14.50	14.50	14.50	14.50	14.50	14.50
1929	18.00	18.00	18.10	18.50	18.80	19.00	19.00	19.00	19.00	19.00	19.00	19.00

Standard Low Phosphorus, delivered Eastern Pennsylvania

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec
1942	$30.74	$30.74	$30.77	$30.81	$30.81	$30.81	$30.81	$30.81	$30.81	$30.81	$30.81	$30.81
1941	30.74	30.74	30.74	30.74	30.74	30.74	30.74	30.74	30.74	30.74	30.74	30.74
1940	29.74	29.74	29.74	29.74	29.74	29.74	29.74	29.74	29.74	29.74	29.74	30.24
1939	27.74	27.74	27.74	27.74	27.74	27.74	27.74	27.74	28.94	29.74	29.74	29.74
1938	29.63	29.63	29.63	29.70	29.74	29.74	26.74	26.74	26.74	27.74	27.74	27.74
1937	26.63	26.88	29.63	29.63	29.63	29.63	29.63	29.63	29.63	29.63	29.63	29.63
1936	25.13	25.13	25.13	25.13	25.13	25.13	25.13	25.13	25.13	25.13	25.38	26.13
1935	24.63	24.63	24.63	24.63	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68
1934	24.13	24.13	24.13	24.13	24.63	24.63	24.63	24.63	24.63	24.63	24.63	24.63
1933	20.75	20.50	20.50	20.50	21.68	22.00	22.80	23.50	23.13	23.13	23.13	24.13
1932	23.76	23.76	23.76	23.76	23.76	23.76	23.76	23.76	23.76	23.76	23.76	23.76
1929	24.26	24.26	24.26	24.26	24.26	24.26	24.26	24.26	24.76	24.76	24.76	24.76

Lake Superior Charcoal, delivered Chicago

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1942	$31.34	$31.34	$31.44	$31.54	$31.54	$31.54	$31.54	$31.54	$31.53	$31.54	$31.54	$31.54
1941	30.34	30.34	30.34	30.34	31.09	31.34	31.34	31.34	31.34	31.34	31.34	31.34
1940	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.84
1939	28.34	28.34	28.34	28.34	28.34	28.34	28.34	29.54	30.34	30.34	30.34	30.34
1938	30.24	30.24	30.24	30.34	30.34	30.34	28.34	28.34	28.34	28.34	28.34	28.34
1937	26.54	26.54	28.93	30.04	30.04	30.04	30.04	30.04	30.04	30.04	30.14	30.24
1936	25.25	25.25	25.25	25.25	25.25	25.25	25.25	25.25	25.25	25.25	25.50	26.25
1935	24.04	24.04	24.04	24.15	24.25	24.25	24.25	24.25	24.25	24.90	25.25	25.25
1934	23.54	23.54	23.54	23.66	24.04	24.04	24.04	24.04	24.04	24.04	24.04	24.04
1933	23.04	23.04	23.04	23.06	23.04	23.04	23.04	23.04	23.54	23.54	23.54	23.54
1932	22.29	23.04	23.04	23.04	23.04	23.04	23.04	23.04	23.04	23.04	24.04	23.04
1929	27.04	27.04	27.04	27.04	27.04	27.04	27.04	27.04	27.04	27.04	27.04	27.04

SEMIFINISHED STEEL

Per Gross Ton f. o. b.

Open-Hearth and Bessemer Billets, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1942	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00
1941	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00
1940	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00
1939	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00
1938	37.00	37.00	37.00	37.00	37.00	37.00	34.00	34.00	34.00	34.00	34.00	34.00
1937	34.00	34.00	36.40	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00
1936	29.00	29.00	28.40	28.00	28.00	28.00	30.00	30.00	30.00	32.00	32.00	32.00
1935	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	28.50	29.00
1934	26.00	26.00	26.00	27.80	29.00	29.00	27.40	27.00	27.00	27.00	27.00	27.00
1933	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00
1932	27.50	27.00	27.00	27.00	27.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00
1929	33.00	34.25	34.00	34.50	36.00	35.75	35.00	35.00	35.00	35.00	35.00	34.75

Open-Hearth and Bessemer Sheet Bars, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1942	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00
1941	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00
1940	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00
1939	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00
1938	37.00	37.00	37.00	37.00	37.00	37.00	34.00	34.00	34.00	34.00	34.00	34.00
1937	34.00	34.00	36.40	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00
1936	30.00	30.00	28.50	28.00	28.00	28.00	30.00	30.00	30.00	32.00	32.00	32.00
1935	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	29.50	30.00
1934	26.00	26.00	26.00	28.40	30.00	30.00	28.40	28.00	28.00	28.00	28.00	28.00
1933	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00
1932	27.50	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00
1929	34.00	36.25	35.00	35.25	36.00	35.75	35.00	35.00	35.00	35.00	35.00	34.75

Wire Rods, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1942	$2.00	$2.00	$2.00	$2.00	$2.00	$2.00	$2.00	$2.00	$2.00	$2.00	$2.00	$2.00
1941	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
1940*	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
1939	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00
1938	47.00	47.00	47.00	47.00	47.00	47.00	43.00	43.00	43.00	43.00	43.00	43.00
1937	43.00	43.00	46.20	47.00	47.00	47.00	47.00	47.00	47.00	47.00	47.00	47.00
1936	40.00	40.00	40.00	40.00	40.00	38.80	38.00	38.00	38.00	40.00	40.00	40.00
1935	38.00	38.00	38.00	38.00	38.00	38.00	38.00	38.00	38.00	38.00	38.50	40.00
1934	36.00	36.00	36.00	37.20	38.00	38.00	38.00	38.00	38.00	38.00	38.00	38.00
1933	36.20	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	36.00
1932	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00
1929	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	40.00	40.00

*Per 100 lbs.

BEEHIVE COKE

Net Ton

Foundry, Spot, Connellsville

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1942	$7.25	$7.25	$7.25	$7.25	$7.25	$7.25	$7.25	$7.25	$7.25	$7.25	$7.25	$7.25
1941	6.00	6.00	6.00	6.00	6.30	7.25	7.25	7.25	7.25	7.25	7.25	7.25
1940	5.75	5.75	5.75	5.75	5.75	5.75	5.75	5.75	5.75	5.75	5.75	6.00
1939	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.80	6.00	5.75
1938	5.25	5.25	5.25	5.25	5.25	5.05	5.00	5.00	5.00	5.00	5.00	5.05
1937	4.25	4.25	4.25	5.05	5.30	5.30	5.30	5.30	5.30	5.30	5.30	5.30
1936	4.00	4.20	4.10	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25
1935	4.60	4.60	4.60	4.60	4.60	4.60	4.25	4.00	4.00	4.35	4.35	4.25
1934	4.25	4.25	4.25	4.55	4.60	4.60	4.60	4.60	4.60	4.60	4.60	4.60
1933	2.50	2.50	2.25	2.25	2.25	2.40	2.80	3.10	3.15	3.85	4.25	4.25
1932	3.25	3.25	3.25	3.25	3.15	3.00	3.00	2.90	2.75	2.75	2.65	2.50
1929	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.55	3.50

Furnace, Spot, Connellsville

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1942	$6.20	$6.00	$6.00	$6.00	$6.00	$6.00	$6.00	$6.00	$6.00	$6.00	$6.00	$6.00
1941	5.50	5.50	5.50	5.50	5.70	6.25	6.25	6.25	6.25	6.25	6.25	6.25
1940	4.75	4.75	4.75	4.75	4.75	4.75	4.75	4.75	4.75	4.75	4.75	5.00
1939	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	4.75	5.00	5.00
1938	4.25	4.25	4.25	4.25	4.25	3.90	3.75	3.75	3.75	3.75	3.75	3.75
1937	4.00	4.00	4.05	4.50	4.85	4.65	4.50	4.50	4.45	4.40	4.37	4.37
1936	3.50	3.50	3.50	3.50	3.50	3.50	3.45	3.45	3.90	4.00	4.00	4.00
1935	3.60	3.60	3.60	3.60	3.60	3.50	3.30	3.25	3.25	3.55	3.55	3.65
1934	3.60	3.50	3.35	3.30	3.45	3.60	3.60	3.60	3.60	3.60	3.60	3.60
1933	1.75	1.75	1.75	1.75	1.75	1.80	2.40	2.75	2.50	3.25	3.75	3.75
1932	2.25	2.25	2.25	2.25	2.15	2.00	2.00	2.00	2.00	2.00	1.80	1.80
1929	2.75	2.90	2.95	2.75	2.75	2.75	2.75	2.75	2.65	2.65	2.65	2.65

STEEL AND IRON SCRAP

Per Gross Ton, Delivered

Heavy Melting Steel, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1942	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00
1941	22.15	20.75	20.75	20.20	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
1940	18.15	17.75	17.05	16.45	18.00	19.90	19.55	18.75	20.15	21.30	21.50	22.50
1939	15.60	15.65	15.75	15.50	14.55	15.00	15.55	16.15	18.75	23.15	21.85	18.50
1938	14.05	14.15	13.65	12.79	11.55	11.40	13.75	15.20	15.25	14.95	14.85	15.75
1937	18.95	19.65	22.40	22.75	19.00	18.40	19.40	21.85	20.40	17.15	14.10	12.75
1936	14.50	14.80	15.75	15.75	14.75	13.80	14.15	16.00	17.75	18.15	17.25	18.50
1935	13.50	13.25	12.40	11.70	12.00	12.25	12.30	13.25	13.45	13.65	13.65	14.05
1934	13.05	13.90	14.35	14.15	12.80	11.90	12.00	11.45	10.75	10.50	11.15	12.95
1933	8.35	8.25	8.75	9.90	11.65	11.65	12.70	13.75	13.00	12.45	11.65	11.50
1932	10.25	10.25	10.25	10.20	9.75	9.00	8.35	8.55	9.50	9.50	9.15	8.75
1929	19.00	18.60	18.50	18.60	17.85	18.30	18.45	18.90	18.45	17.30	16.30	15.10

Heavy Melting Steel, Chicago

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1942	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75
1941	20.15	19.25	19.45	18.80	18.75	18.75	18.75	18.74	18.75	18.75	18.75	18.75
1940	16.45	15.75	15.50	15.25	16.65	18.00	17.45	18.15	19.30	19.85	20.25	20.60
1939	13.75	14.00	14.25	13.35	12.75	13.38	13.55	13.75	16.05	19.25	17.45	16.25
1938	13.25	12.15	12.20	11.45	11.05	10.25	12.05	14.00	13.60	13.05	14.20	13.75
1937	18.25	19.50	20.90	20.75	17.55	16.00	17.75	19.75	17.85	13.95	12.55	11.50
1936	13.40	14.30	14.75	14.35	13.05	12.75	13.25	15.45	16.15	16.25	16.50	16.50
1935	12.15	11.65	10.45	10.05	10.20	10.25	10.40	12.35	12.55	12.50	13.20	13.75
1934	10.44	10.87	12.00	11.75	11.13	9.75	9.55	9.25	8.65	8.75	9.00	10.15
1933	5.25	5.25	5.25	6.55	8.70	8.80	10.45	10.40	9.95	9.35	8.35	8.75
1932	7.25	6.80	6.75	6.55	6.20	5.60	4.50	5.40	5.75	6.00	5.75	5.50
1929	16.50	16.00	15.55	15.95	15.45	14.95	14.75	15.05	15.05	14.45	13.05	12.50

Heavy Melting Steel, Eastern Pennsylvania

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1942	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75
1941	20.56	20.00	20.00	19.06	18.75	18.75	18.75	18.75	18.75	18.75	18.75	18.75
1940	18.15	17.50	17.15	16.75	17.40	19.65	19.05	19.75	20.70	20.75	20.75	20.75
1939	15.25	15.25	15.37	15.65	15.25	15.44	15.60	16.44	18.95	22.12	20.70	18.85
1938	14.95	14.75	14.44	13.45	12.25	11.85	13.72	14.50	14.25	14.65	14.75	15.20
1937	17.50	18.75	19.75	20.44	18.40	17.03	18.40	19.75	19.22	16.55	14.00	14.00
1936	12.37	13.15	13.46	13.75	12.65	11.70	12.25	13.85	15.37	15.65	14.81	15.63
1935	11.40	11.25	10.60	10.15	10.45	10.45	10.30	11.40	12.20	12.00	12.05	12.25
1934	11.63	11.73	11.70	11.50	11.00	10.40	10.25	9.85	9.60	9.50	9.95	10.85
1933	6.50	6.50	6.50	6.90	9.00	9.50	10.55	12.00	10.70	10.20	9.55	10.50
1932	7.50	7.35	7.35	7.20	6.50	6.25	6.25	6.40	7.25	7.25	7.25	6.50
1929	16.50	16.30	16.25	17.00	16.25	16.25	16.50	16.75	16.37	15.80	15.15	14.50

Compressed Sheets, Detroit (Dealers)

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1942	$17.85	$17.85	$17.85	$17.85	$17.85	$17.85	$17.85	$17.85	$17.85	$17.85	$17.85	$17.85
1941	19.20	17.90	17.70	17.85	17.85	17.85	17.85	17.85	17.85	17.85	17.85	17.85
1940	13.90	13.65	13.25	13.75	15.65	17.70	16.60	17.25	17.90	18.40	18.15	18.50
1939	11.95	12.00	12.10	11.50	10.55	11.05	11.95	12.75	14.80	18.25	17.40	14.45
1938	10.50	10.50	9.95	8.45	7.60	7.30	10.20	11.45	11.85	11.65	11.80	11.90
1937	15.75	16.10	18.25	19.15	16.55	15.50	17.00	18.25	17.95	14.15	10.40	10.30
1936	10.45	11.55	12.50	12.10	10.85	10.50	11.05	12.75	14.25	14.40	13.60	13.95
1935	10.00	9.60	7.95	7.75	7.95	8.50	8.75	9.80	10.05	10.05	9.75	9.90
1934	8.50	9.40	10.30	9.70	8.90	7.90	8.00	7.80	7.75	7.50	7.75	9.00
1933	4.00	4.00	4.06	5.15	7.50	7.80	8.85	9.50	8.55	7.35	7.00	7.45
1932	5.55	5.75	5.75	5.70	5.10	4.75	3.75	3.80	5.00	5.50	5.05	4.06
1929	14.65	14.45	14.00	14.00	14.00	13.65	14.00	14.00	14.00	13.40	12.15	11.50

No. 1 Cast, Eastern Pennsylvania

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1942	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00
1941	24.25	24.25	25.10	25.10	23.00	23.00	23.00	23.00	23.00	23.00	23.00	22.25
1940	20.75	19.75	19.70	19.70	20.40	21.65	21.50	21.65	22.25	22.50	22.95	23.25
1939	16.75	16.75	16.75	16.50	16.25	16.25	16.35	16.90	19.75	23.50	22.25	20.95
1938	16.25	16.20	15.75	15.30	14.75	14.75	15.85	16.75	16.75	16.75	16.75	16.75
1937	18.85	19.00	20.69	22.50	20.35	18.81	19.55	21.65	20.50	18.95	16.75	16.25
1936	12.75	13.45	17.00	14.88	14.15	13.75	14.31	15.55	16.62	16.65	16.25	17.75
1935	11.60	11.95	11.75	11.55	11.50	11.50	11.50	11.60	12.25	12.25	12.75	12.75
1934	11.50	11.65	12.30	12.50	12.15	12.00	11.25	11.00	11.00	11.00	11.00	12.25
1933	9.00	9.00	9.00	9.10	10.25	10.35	11.20	11.75	12.40	12.00	11.95	12.00
1932	11.20	10.00	10.00	9.50	9.25	9.00	9.00	9.25	9.25	9.00	9.00	9.00
1929	16.73	16.75	16.50	16.50	16.50	16.50	16.50	16.50	16.25	16.25	16.00	16.00

Cast Borings, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1942	$16.00	$16.00	$16.00	$16.00	$16.00	$16.00	$16.00	$16.00	$16.00	$16.00	$16.00	$16.00
1941	15.40	15.50	16.80	15.90	15.30	15.25	15.25	15.25	15.25	15.25	15.25	15.25
1940	12.00	9.65	8.50	8.85	9.65	10.75	11.40	12.50	13.40	14.00	14.25	15.50
1939	8.25	8.25	8.55	8.75	7.35	6.75	8.10	8.95	10.00	12.50	13.80	12.35
1938	7.25	7.25	6.75	6.25	6.25	5.90	7.05	7.75	8.15	8.65	8.50	8.50
1937	14.40	14.00	14.40	14.50	14.10	14.00	14.65	15.20	14.90	12.95	8.75	7.25
1936	8.30	8.75	8.70	8.75	8.75	8.05	7.90	10.90	11.95	11.65	11.50	13.00
1935	6.50	6.90	7.00	6.10	6.00	6.65	6.50	7.00	7.30	8.15	8.15	8.00
1934	7.30	8.15	8.70	8.50	8.25	7.75	7.25	7.03	6.25	5.50	5.90	6.00
1933	5.70	5.70	5.55	5.70	6.90	7.65	9.05	9.80	9.05	8.30	7.60	7.50
1932	6.75	6.50	6.75	6.65	6.40	3.50	4.75	5.15	5.95	6.25	6.50	5.90
1929	12.55	12.25	11.50	12.15	11.55	11.85	12.10	12.50	12.40	11.80	11.15	10.75

Machine Shop Turnings, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1942	$16.00	$16.00	$16.00	$16.00	$16.00	$16.00	$16.00	$16.00	$16.00	$16.00	$16.00	$16.00
1941	15.25	15.25	15.70	15.65	15.50	15.50	15.50	15.50	15.50	15.50	15.50	15.50
1940	12.50	10.90	10.45	10.10	11.65	13.50	14.10	14.00	15.40	15.50	15.50	16.25
1939	9.50	9.50	9.65	9.75	8.50	8.25	9.15	10.15	11.65	14.60	14.75	13.15
1938	8.00	8.85	7.75	7.05	6.75	6.30	7.85	9.25	9.45	9.65	9.70	10.00
1937	14.15	14.25	15.55	15.25	14.80	14.00	14.05	15.05	14.75	11.75	8.55	7.25
1936	9.75	10.20	10.50	10.50	9.75	9.40	9.50	10.70	12.40	12.45	11.75	12.90
1935	8.95	8.80	7.40	7.40	8.15	8.25	8.15	8.80	9.55	9.70	9.45	9.65
1934	9.05	10.00	10.75	10.15	8.20	7.45	7.50	8.00	7.30	7.00	7.20	8.50
1933	6.25	6.25	6.30	6.75	8.00	8.40	9.35	10.45	9.75	9.30	8.00	8.00
1932	6.95	7.10	7.25	6.75	6.30	5.25	5.00	5.25	5.95	6.00	6.25	6.00
1929	12.50	11.25	10.65	11.05	11.00	11.35	11.85	12.40	12.00	11.40	10.75	10.25

FINISHED STEEL

Per Pound f. o. b.

Steel Bars, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1942	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c
1941	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15
1940	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15
1939	2.25	2.25	2.25	2.25	2.20	2.15	2.15	2.15	2.15	2.15	2.15	2.15
1938	2.45	2.45	2.45	2.45	2.45	2.45	2.25	2.25	2.25	2.25	2.25	2.25
1937	2.20	2.20	2.40	2.45	2.45	2.45	2.45	2.45	2.45	2.45	2.45	2.45
1936	1.85	1.85	1.85	1.85	1.85	1.85	1.95	1.95	1.95	2.05	2.05	2.05
1935	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.85	1.85	1.85	1.85
1934	1.75	1.75	1.75	1.85	1.90	1.90	1.80	1.80	1.80	1.80	1.80	1.80
1933	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.75	1.75	1.75
1932	1.55	1.50	1.55	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1929	1.90	1.90	1.90	1.95	1.95	1.95	1.95	1.95	1.95	1.90	1.90	1.90

Tank Plates, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1942	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c
1941	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
1940	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
1939	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
1938	2.25	2.25	2.25	2.25	2.25	2.25	2.10	2.10	2.10	2.10	2.10	2.10
1937	2.05	2.05	2.20	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25
1936	1.80	1.80	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.90	1.90	1.90
1935	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80
1934	1.70	1.70	1.70	1.80	1.85	1.85	1.80	1.80	1.80	1.80	1.80	1.80
1933	1.60	1.60	1.60	1.55	1.50	1.55	1.60	1.60	1.60	1.70	1.70	1.70
1932	1.55	1.50	1.55	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1929	1.90	1.90	1.90	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.90	1.90

Structural Shapes, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1942	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c
1941	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
1940	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
1939	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
1938	2.25	2.25	2.25	2.25	2.25	2.25	2.10	2.10	2.10	2.10	2.10	2.10
1937	2.05	2.05	2.20	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25
1936	1.80	1.80	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.90	1.90	1.90
1935	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80
1934	1.70	1.70	1.70	1.80	1.85	1.85	1.80	1.80	1.80	1.80	1.80	1.80
1933	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.70	1.70	1.70
1932	1.55	1.50	1.55	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1929	1.90	1.90	1.90	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.90	1.90

Hot Rolled Sheets, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1942	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c
1941	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
1940	2.10	2.10	2.10	1.98	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
1939	2.15	2.15	2.15	2.15	2.05	2.09	2.00	2.00	2.00	2.00	2.00	2.10
1938	2.40	2.40	2.40	2.40	2.40	2.40	*2.15	2.15	2.15	2.10	2.15	2.15
1937	2.15	2.15	2.35	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40
1936	1.85	1.85	1.85	1.85	1.85	1.85	1.95	1.95	1.95	1.95	1.95	2.10
1935	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85
1934	1.75	1.75	1.75	1.90	2.00	2.00	1.85	1.85	1.85	1.85	1.85	1.85
1933	1.65	1.60	1.55	1.55	1.55	1.65	1.75	1.65	1.70	1.75	1.75	1.75
1932	1.75	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70
1929	2.10	2.10	2.10	2.15	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.15

*Succeeded No. 10 blue annealed June 24, 1938.

Cold Rolled Sheets, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1942	3.05c	3.05c	3.05c	3.05c	3.05c	3.05c	3.05c	3.05c	3.05c	3.05c	3.05c	3.05c
1941	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05
1940	3.05	3.05	3.05	2.93	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05
1939	3.20	3.20	3.20	3.20	3.10	3.05	3.05	3.05	3.05	3.05	3.05	3.05
1938	3.55	3.45	3.45	3.45	3.45	3.45	3.20	3.20	3.20	3.20	3.20	3.20
1937	3.25	3.25	3.50	3.55	2.55	3.55	3.55	3.55	3.55	3.55	3.55	3.55
1936	2.95	2.95	2.95	2.95	2.95	2.95	3.05	3.05	3.05	3.05	3.05	3.05
1935	2.95	2.95	2.95	2.95	2.95	2.95	2.95	2.95	2.95	2.95	2.95	2.95
1934	2.75	2.75	2.75	3.05	3.15	3.10	2.95	2.95	2.95	2.95	2.95	2.95
1933	2.40	2.45	2.45	2.55	2.55	2.55	2.55	2.60	2.75	2.75	2.75	2.75
1932	2.90	2.85	2.85	2.80	2.80	2.80	2.80	2.70	2.75	2.65	2.60	2.60
1929	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.05	4.00	4.00

No. 24 Galvanized Sheets, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1942	3.50c	3.50c	3.50c	3.50c	3.50c	3.50c	3.50c	3.50c	3.50c	3.50c	3.50c	3.50c
1941	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
1940	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
1939	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
1938	3.80	3.80	3.80	3.80	3.80	3.75	3.50	3.50	3.50	3.50	3.50	3.50
1937	3.40	3.40	3.70	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80
1936	3.10	3.10	3.10	3.10	3.10	3.10	3.20	3.20	3.20	3.20	3.20	3.35
1935	3.10	3.10	3.10	3.10	3.10	3.10	3.10	3.10	3.10	3.10	3.10	3.10
1934	2.85	2.85	2.85	3.10	3.25	3.25	3.10	3.10	3.10	3.10	3.10	3.10
1933	2.70	2.50	2.60	2.65	2.70	2.70	2.85	2.85	2.85	2.85	2.85	2.85
1932	2.80	2.75	2.80	2.85	2.85	2.85	2.85	2.80	2.75	2.80	2.85	2.85
1929	3.60	3.60	3.60	3.65	3.70	3.65	3.60	3.55	3.50	3.50	3.45	3.40

Cold Finished Steel Bars, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1942	2.65c	2.65c	2.65c	2.65c	2.65c	2.65c	2.65c	2.65c	2.65c	2.65c	2.65c	2.65c
1941	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.62	2.65	2.65
1940	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65
1939	2.70	2.70	2.70	2.70	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65
1938	2.90	2.90	2.90	2.90	2.90	2.90	2.70	2.70	2.70	2.70	2.70	2.70
1937	2.55	2.55	2.85	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90
1936	2.10	2.10	2.10	2.10	2.10	2.15	2.25	2.25	2.25	2.35	2.35	2.55
1935	2.10	2.10	2.10	2.00	1.95	1.95	1.95	1.95	1.95	1.95	1.95	2.05
1934	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
1933	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.95	1.95	1.95	1.95	1.95
1932	2.00	2.00	1.90	1.90	1.75	1.70	1.70	1.70	1.70	1.70	1.70	1.70
1929	2.20	2.20	2.25	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.20	2.20

Tin Plate, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1942	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00
1941	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
1940	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
1939	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
1938	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	*5.10	5.00
1937	4.85	4.85	4.85	5.25	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35
1936	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25
1935	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25
1934	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25
1933	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.65	4.65	4.65	5.25
1932	4.75	4.75	4.75	4.75	4.75	4.75	4.75	4.75	4.75	4.75	4.50	4.25
1929	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35

*Refund of 25 cents per box on all contracts Jan. 1 to Nov. 10, 1938.

Cold Rolled Strip, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1942	2.80c	2.80c	2.80c	2.80c	2.80c	2.80c	2.80c	2.80c	2.80c	2.80c	2.80c	2.80c
1941	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80
1940	2.80	2.80	2.80	2.68	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80
1939	2.95	2.95	2.95	2.95	2.85	2.80	2.80	2.80	2.80	2.80	2.80	2.80
1938	3.20	3.20	3.20	3.20	3.20	3.10	2.95	2.95	2.95	2.90	2.90	2.90
1937	2.85	2.85	3.15	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
1936	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.80
1935	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60
1934	2.40	2.40	2.40	2.65	2.80	2.80	2.60	2.60	2.60	2.60	2.60	2.60
1933	1.95	1.80	1.85	1.80	1.90	2.00	2.25	2.25	2.30	2.40	2.40	2.40
1932	2.00	1.90	2.00	2.00	2.00	2.00	2.00	2.00	2.00	1.95	2.00	2.00
1929	2.85	2.85	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75

Hot Rolled Strip, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1942	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c
1941	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
1940	2.10	2.10	2.10	1.98	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
1939	2.15	2.15	2.15	2.15	2.05	2.00	2.00	2.00	2.00	2.00	2.00	2.10
1938	2.40	2.40	2.40	2.40	2.40	2.40	2.15	2.15	2.15	2.10	2.10	2.10
1937	2.15	2.15	2.35	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40
1936	1.85	1.85	1.85	1.85	1.85	1.85	1.95	1.95	1.95	1.95	1.95	2.10
1935	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85
1934	1.75	1.75	1.75	1.95	2.00	2.00	1.85	1.85	1.85	1.85	1.85	1.85
1933	1.45	1.45	1.45	1.45	1.55	1.55	1.60	1.65	1.70	1.75	1.75	1.75
1932	1.40	1.40	1.40	1.45	1.50	1.50	1.45	1.45	1.45	1.45	1.45	1.45
1929	1.80	1.85	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90

Plain Wire, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1942	2.60c	2.60c	2.60c	2.60c	2.60c	2.60c	2.60c	2.60c	2.60c	2.60c	2.60c	2.60c
1941	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60
1940	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60
1939	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60
1938	2.90	2.90	2.90	2.90	2.90	2.90	2.60	2.60	2.60	2.60	2.60	2.60
1937	2.60	2.60	2.85	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90
1936	2.30	2.30	2.30	2.40	2.40	2.40	2.40	2.40	2.40	2.50	2.50	2.60
1935	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
1934	2.20	2.20	2.20	2.25	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
1933	2.15	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.20
1932	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20
1929	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.45	2.40	2.40	2.40

Wire Nails, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.
1942	2.55c	2.55c	2.55c	2.55c	2.55c	2.55c	2.55c	2.55c	2.55c	2.55c	2.55c	2.55c
1941	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55
1940	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55
1939	2.45	2.45	2.45	2.45	2.45	2.45	2.40	2.40	2.40	2.50	2.55	2.55
1938	2.75	2.75	2.75	2.75	2.75	2.75	2.45	2.45	2.45	2.45	2.45	2.45
1937	2.25	2.25	2.70	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75
1936	2.40	2.40	2.15	2.10	2.10	2.10	2.10	2.10	1.95	2.05	2.05	2.20
1935	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.55	2.40	2.40	2.40	2.40
1934	2.35	2.35	2.35	2.50	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60
1933	1.90	1.85	1.85	1.85	1.85	1.85	2.05	2.10	2.10	2.10	2.10	2.35
1932	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95
1929	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.50	2.45	2.40	2.40

Rail Steel Bars, Chicago

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1942	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c
1941	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15
1940	2.15	2.15	2.10	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.10	2.10
1939	2.10	2.10	2.10	2.10	2.05	2.00	2.00	2.00	2.03	2.15	2.15	2.15
1938	2.35	2.35	2.35	2.35	2.35	2.35	2.15	2.10	2.10	2.10	2.10	2.10
1937	2.10	2.10	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
1936	1.75	1.75	1.75	1.75	1.75	1.75	1.85	1.85	1.85	1.95	1.95	1.95
1935	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75
1934	1.70	1.70	1.70	1.79	1.85	1.85	1.77	1.75	1.75	1.75	1.75	1.75
1933	1.50	1.45	1.45	1.45	1.50	1.50	1.50	1.50	1.60	1.70	1.70	1.70
1932	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
1929	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.90	1.95	1.90

Structural Rivets, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1942	3.75c	3.75c	3.75c	3.75c	3.75c	3.75c	3.75c	3.75c	3.75c	3.75c	3.75c	3.75c
1941	3.40	3.40	3.40	3.40	3.50	3.75	3.75	3.75	3.75	3.75	3.75	3.75
1940	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40
1939	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40
1938	3.60	3.60	3.60	3.60	3.60	3.60	3.40	3.40	3.40	3.40	3.40	3.40
1937	3.25	3.25	3.45	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60
1936	2.90	2.90	2.90	2.90	2.90	2.95	3.05	3.05	3.05	3.05	3.05	3.20
1935	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90
1934	2.75	2.75	2.75	2.90	3.00	3.00	2.95	2.90	2.90	2.90	2.90	2.90
1933	2.25	2.25	2.25	2.25	2.25	2.35	2.50	2.50	2.50	2.60	2.75	2.75
1932	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25
1929	2.85	2.90	2.95	3.10	3.10	3.10	3.10	3.10	3.10	3.10	3.10	3.10

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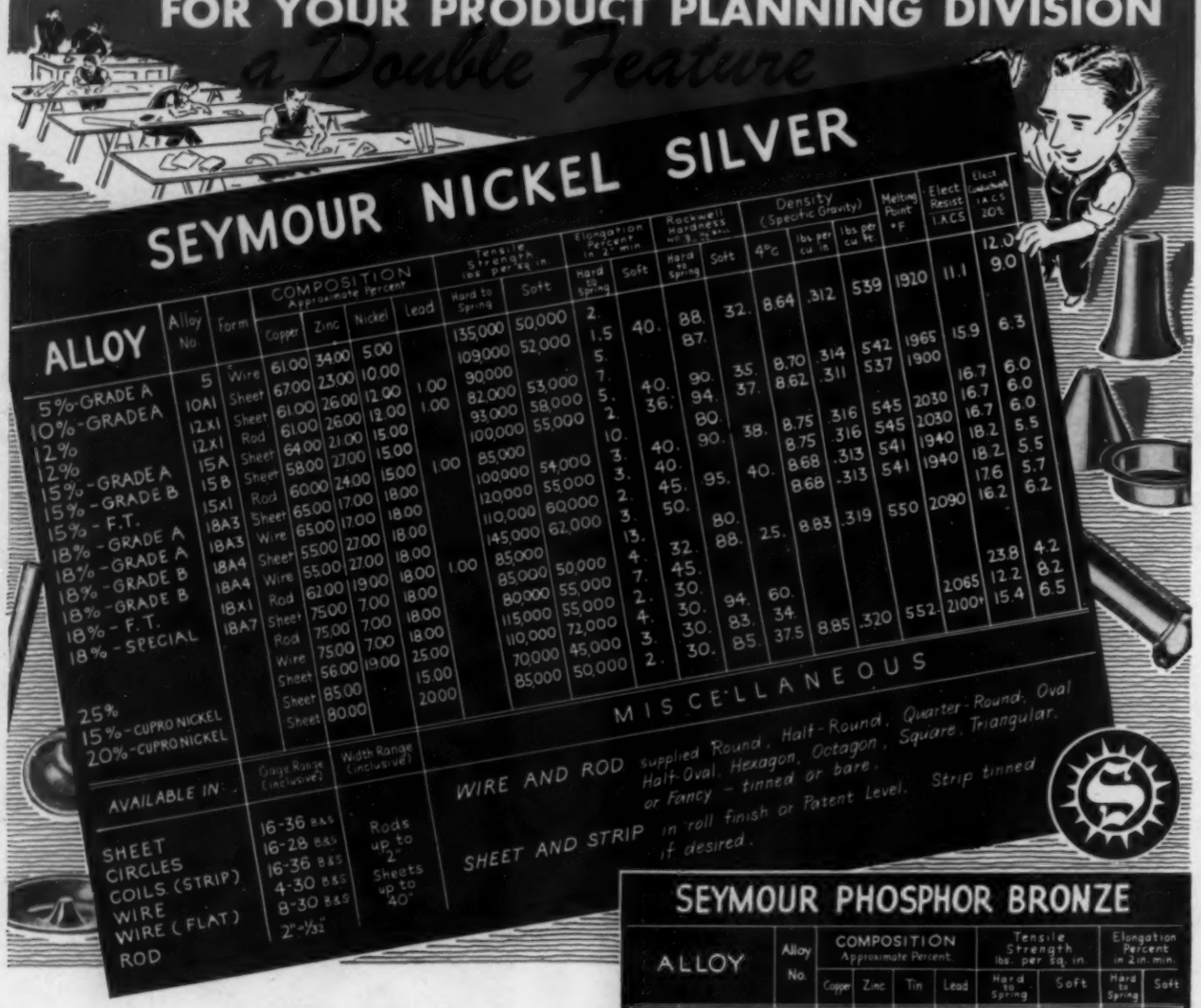


SEYMOUR NICKEL SILVER

ALLOY	Alloy No.	Form	Composition Approximate Percent: Copper	Zinc	Nickel	Lead	Tensile Strength lbs. per sq. in.: Hard to Spring	Soft	Elongation Percent in 2" min.: Hard to Spring	Soft	Rockwell Hardness No. B Scale: Hard to Spring	Soft	Density (Specific Gravity): 4°C	lbs. per cu. in.	lbs. per cu. ft.	Melting Point °F	Elect. Resist. I.A.C.S.	Elect. Conductivity I.A.C.S. 20°C
5%-GRADE A	5	Wire	61.00	34.00	5.00		135,000	50,000	2									12.0
10%-GRADE A	10A1	Sheet	67.00	23.00	10.00		109,000	52,000	1.5	40.	88.	32.	8.64	.312	539	1910	11.1	9.0
12%	12X1	Sheet	61.00	26.00	12.00	1.00	90,000		5.		87.							
12%	12X1	Rod	61.00	26.00	12.00	1.00	82,000	53,000	7.									
15%-GRADE A	15A	Sheet	64.00	21.00	15.00		93,000	58,000	5.	40.	90.	35.	8.70	.314	542	1965	15.9	6.3
15%-GRADE B	15B	Sheet	58.00	27.00	15.00	1.00	100,000	55,000	2.	36.	94.	37.	8.62	.311	537	1900		
15%-F.T.	15X1	Rod	60.00	24.00	18.00		85,000		10.		80.						16.7	6.0
18%-GRADE A	18A3	Sheet	65.00	17.00	18.00		100,000	54,000	3.	40.	90.	38.	8.75	.316	545	2030	16.7	6.0
18%-GRADE A	18A3	Wire	65.00	17.00	18.00		120,000	55,000	3.	40.			8.75	.316	545	2030	16.7	6.0
18%-GRADE B	18A4	Sheet	55.00	27.00	18.00		110,000	60,000	2.	45.	95.	40.	8.68	.313	541	1940	18.2	5.5
18%-GRADE B	18A4	Wire	55.00	27.00	18.00		145,000	62,000	3.	50.			8.68	.313	541	1940	18.2	5.5
18%-F.T.	18X1	Rod	62.00	19.00	18.00		85,000		13.		80.						17.6	5.7
18%-SPECIAL	18A7	Sheet	75.00	7.00	18.00		85,000	50,000	4.	32.	88.	25.	8.83	.319	550	2090	16.2	6.2
		Rod	75.00	7.00	18.00		80,000	55,000	7.	45.								
		Wire	75.00	7.00	18.00		115,000	55,000	2.	30.							23.8	4.2
		Sheet	56.00	19.00	25.00		110,000	72,000	4.	30.	94.	60.					12.2	8.2
		Sheet	85.00		15.00		70,000	45,000	3.	30.	83.	34.				2065	15.4	6.5
25%		Sheet	80.00		20.00		85,000	50,000	2.	30.	85	37.5	8.85	.320	552	2100+		

AVAILABLE IN:	Gage Range (inclusive)	Width Range (inclusive)
SHEET	16-36 B&S	Rods up to 2"
CIRCLES	16-28 B&S	
COILS (STRIP)	16-36 B&S	
WIRE	4-30 B&S	Sheets up to 40"
WIRE (FLAT)	8-30 B&S	
ROD	2"-1/32"	

MISCELLANEOUS

WIRE AND ROD supplied Round, Half-Round, Quarter-Round, Oval, Half-Oval, Hexagon, Octagon, Square, Triangular, or Fancy — tinned or bare.

SHEET AND STRIP in roll finish or Patent Level. Strip tinned if desired.

SEYMOUR PHOSPHOR BRONZE

ALLOY	Alloy No.	Composition Approximate Percent: Copper	Zinc	Tin	Lead	Tensile Strength lbs. per Sq. in.: Hard to Spring	Soft	Elongation Percent in 2 in. min.: Hard to Spring	Soft
GRADE A (Sheet)*	950	95.00		5.00		105,000	45,000	1.5	50
" B (Rod)*	494	94.00		5.00	1.00	61,000	50,000		40
" C (Sheet)*	928	92.00		8.00		112,000	55,000	3	
" D (")*	910	90.00		10.00		115,000	60,000	5	65
PHOSPH. BRONZE (Rod)*	444	88.00	4.00	4.00	4.00	*60,000		20	

*Contain Phosphorus. *Small Size Only.

DITTO	Alloy No.	Rockwell Hardness No. "F" Ball 100 Kg.: Hard to Spring	Soft	Density or Spec. Grav.: 4°C	lbs. per cu. in.	lbs. per cu. ft.	Melting Point °F	Elect. Resist. I.A.C.S.	Elect. Conductivity % I.A.C.S. 20°C
DITTO	950	95	30	8.86	.320	552	1920	6.1	16.5
	494	85						6.0	16.8
	928	98	38	8.80	.318	549		7.8	12.8
	910	100	52	8.76	.316	546		9.4	10.6
	444	75		8.86	.320	552	1830	8.2	12.2

AVAILABLE IN:	Gage Range (inclusive)	Width Range (inclusive)
SHEET	16-36 B&S	Rods up to 2"
BRIDGE PLATES	3/4"-1/8"	
CIRCLES	16-28 B&S	
COILS (STRIP)	16-36 B&S	
WIRE	4-30 B&S	Sheets up to 40"
WIRE (Flat)	8-30 B&S	
ROD	2"-1/32"	
ROD (Welding)		

MISCELLANEOUS

WIRE AND ROD supplied Round, Half-Round, Quarter-Round, Oval, Half-Oval, Hexagon, Octagon, Square, Triangular or Fancy-tinned or bare. *SHEET AND STRIP* in roll finish or Patent Level. Strip tinned if desired.

HUNTING for data these days is expensive. Yet, a good understanding of the possibilities of materials being worked is necessary for best results. So, to save your time, here are the principal characteristics of two Seymour Alloys—long-time stand-bys in peace production, now vital features in war production:

SEYMOUR NICKEL SILVER — Takes any hardness from dead soft to spring temper. Excellent for deep draws and difficult spinning. Has fine grain and good corrosion resistance. Its silvery white color makes it an ideal base for plated items. Leaded, it machines freely.

SEYMOUR PHOSPHOR BRONZE — Highly resistant to corrosion, abrasion, friction and fatigue. Produces springs that withstand almost indefinite flexure. Practically indifferent to thermal variation in most ordinary uses. Has wide application in electrical design. Available leaded; also in rods for welding.

SEYMOUR

Non-Ferrous Alloys Since 1878

THE SEYMOUR MFG. CO., SEYMOUR, CONN.

Cast Iron Pipe, Birmingham

6-Inch and larger, per net ton

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1942	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00
1941	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00
1940	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00
1939	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	45.00	45.00	45.00
1938	46.00	46.00	46.00	46.00	46.00	46.00	42.60	42.00	42.00	42.00	42.00	42.00
1937	41.00	41.00	44.75	46.00	46.00	46.00	46.00	46.00	46.00	46.00	46.00	46.00
1936	39.00	39.00	39.00	39.00	39.00	39.00	39.00	39.00	39.00	39.00	39.00	41.00
1935	38.00	38.00	38.00	38.50	39.00	39.00	39.00	39.00	39.00	39.00	39.00	39.00
1934	36.00	36.00	36.00	36.00	36.00	36.40	38.00	38.00	38.00	38.00	38.00	38.00
1933	32.00	32.00	32.00	32.00	32.00	34.25	35.00	35.00	35.00	35.00	35.25	36.00
1932	33.00	32.20	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00
1929	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00

Steel, Iron and Scrap Price Composites

Compiled by STEEL

Finished Steel Price Composite

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yr's Av.
1942	$56.73	$56.73	$56.73	$56.73	$56.73	$56.73	$56.73	$56.73	$56.73	$56.73	$56.73	$56.73	$56.73
1941	56.73	56.73	56.73	56.73	56.73	56.73	56.73	56.73	56.73	56.73	56.73	56.73	56.73
1940	56.73	56.73	56.73	56.08	56.73	56.73	56.73	56.73	56.73	56.73	56.73	56.73	56.68
1939	57.36	57.36	57.36	57.36	56.74	56.36	56.29	56.27	56.27	56.49	56.54	56.73	56.76
1938	62.18	62.05	62.00	62.00	62.00	61.45	58.00	58.00	58.00	57.78	57.52	57.36	59.86
1937	55.18	55.18	60.14	61.95	62.18	62.18	62.18	62.18	62.18	62.18	62.18	62.18	60.82

Average of industry-wide prices on sheet, strip, bars, plates, shapes, wire, nails, tin plate, standard and line pipe.

Semifinished Steel Price Composite

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yr's Av.
1942	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00
1941	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00
1940	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00
1939	36.60	36.60	36.60	36.60	36.60	36.60	36.60	36.60	36.60	36.60	36.60	36.15	36.56
1938	40.00	40.00	40.00	40.00	40.00	40.00	36.60	36.60	36.60	36.60	36.60	36.60	38.30
1937	36.20	36.20	39.24	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	39.30

Average of industry-wide prices on billets, slabs, sheet bars, skelp and wire rods.

Steelmaking Pig Iron Price Composite

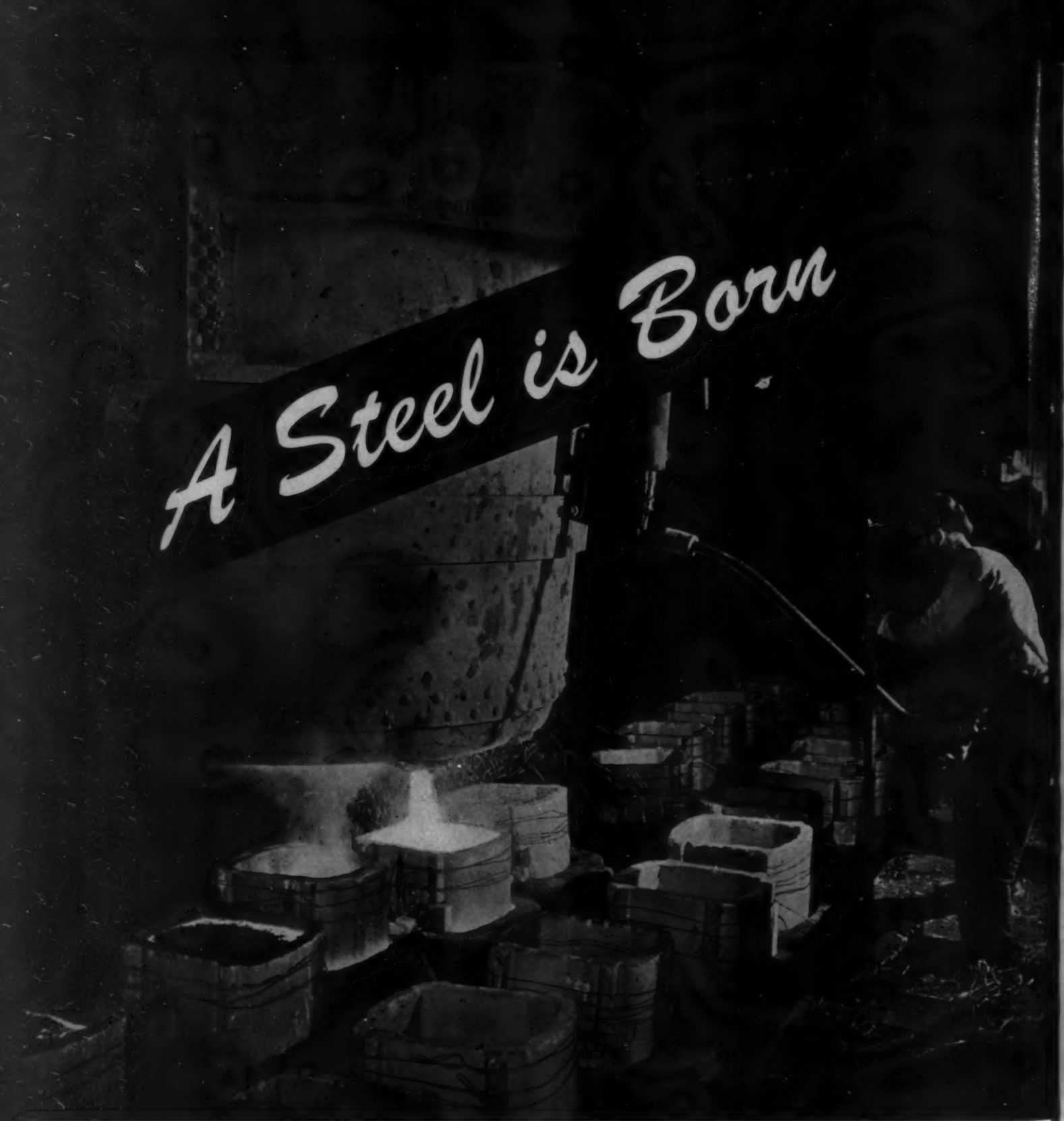
	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yr's Av.
1942	$23.05	$23.05	$23.05	$23.05	$23.05	$23.05	$23.05	$23.05	$23.05	$23.05	$23.05	$23.05	$23.05
1941	22.80	22.95	23.05	23.05	23.05	23.05	23.05	23.05	23.05	23.05	23.05	23.05	23.05
1940	22.05	22.05	22.05	22.05	22.05	22.05	22.05	22.05	22.05	22.05	22.05	22.32	22.07
1939	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	21.05	22.05	22.05	22.05	20.63
1938	22.92	22.92	22.92	23.02	23.05	23.05	19.05	19.05	19.05	20.05	20.05	20.05	21.26
1937	19.96	19.98	22.10	22.84	22.84	22.84	22.84	22.84	22.84	22.84	22.84	22.90	22.31

Average of basic pig iron prices at Bethlehem, Birmingham, Buffalo, Chicago, Cleveland, Neville Island, Granite City and Youngstown.

Steelmaking Scrap Price Composite

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yr's Av.
1942	$19.17	$19.17	$19.17	$19.17	$19.17	$19.17	$19.17	$19.17	$19.17	$19.17	$19.17	$19.17	$19.17
1941	21.00	20.05	20.15	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.50
1940	17.60	17.10	16.55	16.19	17.30	19.15	18.65	18.80	20.20	20.70	20.80	21.40	18.70
1939	14.90	14.95	15.15	14.80	14.10	14.60	14.90	15.35	18.15	21.55	20.15	17.95	16.40
1938	14.10	13.70	13.40	12.60	11.60	11.10	13.30	14.55	14.35	14.15	14.70	14.90	13.55
1937	18.45	19.40	21.25	21.40	18.50	17.05	18.70	20.50	19.15	16.00	13.50	13.40	18.10

Average of No. 1 heavy melting steel scrap at Pittsburgh, Chicago and eastern Pennsylvania.



Pouring the first heat of a new "A.W." Alloy Steel is a moment to long remember. The promise of Victory and the vision of a better America are in every hot top ingot. Our first thought today is to produce the best steels possible in the greatest volume for ships, tanks, guns or the equipment which produces them. If you are engaged in war production and have an alloy steel problem, we will do our best to help you. Personal attention has been the keynote of "A.W." service since 1826.

ALAN WOOD STEEL COMPANY

MAIN OFFICE AND MILLS: CONSHOHOCKEN, PENNSYLVANIA : SINCE 1826. District Offices and Representatives: Philadelphia, New York, Boston, Atlanta, Buffalo, Chicago, Cincinnati, Cleveland, Denver, Detroit, Houston, St. Paul, New Orleans, Pittsburgh, Roanoke, Sanford, N. C., St. Louis, Los Angeles, San Francisco, Seattle, Montreal.

Steel Industry Prepares For Greatest Effort in 1943

Tremendous expansion under way to supply war needs. . . . Building restrictions reflected in shrinking orders. . . . Soft spots appear in scrap market despite continued scarcity threat

DEMAND
Heavy for war goods.

PRODUCTION
Steady in most districts.

PRICES
Unchanged.

ENTERING a year scheduled to see the greatest expansion in capacity ever attempted, the steel industry is set to accomplish goals that seemed fantastic a year ago.

The program for 1943 includes an increase of 6,833,000 tons of steel ingots over the capacity in December, 1942, to a total of 97,115,000 tons. This is a growth of 10,290,000 tons over January, 1942. Blast furnace capacity is planned to rise to 70,850,000 tons by the end of August, 1943, against 64,440,000 tons at the end of December, 1942, an increase of 6,410,000 tons.

To accomplish this immense production necessitates a correspondingly larger supply of raw materials and plans are being laid to provide these. Ore, coke and limestone tonnage is being increased in step with steelmaking capacity.

To match heavy war demand to this enlarged output War Production Board is putting into effect its new Controlled Materials Plan, which is expected to achieve a better balance than has been possible under other plans.

• • •

At the turn of the year buying is relatively light because of shifts in character of war demand and imminence of the new plan of distribution. Pressure for many forms of steel continues heavy but for those under restrictions volume is light. Indications are that an intensified production to support the war will call for greatly enlarged output of many steel products while further curtailing some of those now being held near a minimum.

Shipbuilding promises to hold its place as a leading consumer and output of plates for ships and fittings is expected to be larger than it has been in the past year. Airplane and other war equipment programs are to be greatly increased and the steel industry will feel the impact of demand to feed the enlarged manufacturing capacity.

Current demand is well sustained, with improvement expected in January. Some accumulation of inquiry has been made and with PRP quotas coming out more freely heavier releases may be expected. Small carbon bars with high ratings may be booked under promises of delivery in six to eight weeks but large rounds are quoted at second quarter delivery. Cold-finished carbon bars are available in 35 to 40 weeks. Sheet producers offer hot-rolled with ratings down to AA-3 and AA-4 within eight weeks, though some can apply this only to AA-2 and others can deliver no sooner than mid-March. Cold-finished sheets are available in some cases by the middle of February and in others not until second quarter.

Steel production in the final week continued steady in most districts, at a general average of about 99 per cent of capacity. Pittsburgh advanced ½-point to 98 per cent at midweek, but floods will reduce its average for the week. New England rose 4 points to 100 per cent. Chicago dropped ½-point to 102 per cent, Cincinnati 1 point to 85, Cleveland 2 points to 92½ and Wheeling 3 points to 82½. Floods also affected the Wheeling district. In the remaining six districts rates were unchanged from the previous week: Youngstown, 97; Buffalo, 90½; St. Louis, 93; eastern Pennsylvania, 95; Birmingham, 95; Detroit, 89.

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While scrap supply is not too plentiful in face of winter weather and shortage of labor some soft spots have developed in grades not in demand at points of origin, which must be shipped some distance to consumers in need. In such instances shading has been done to move the material. This is not widespread and does not betoken a weak market. In general, supply is sufficient for current needs and many consumers have several weeks supply in reserve, though not sufficient in most cases to tide over until cold weather is past and collections are enlarged. Meanwhile, government salvage agencies continue campaigns to obtain dormant scrap from sources requiring special treatment to make it available. Tonnages resulting from the autumn household collection are being worked over and much of this is being supplied to melters along with industrial scrap resulting from manufacturing operations.

Restrictions on building are reflected increasingly in statistics of the fabricating industry. American Institute of Steel Construction reports November bookings were 45,972 tons, compared with 184,043 tons in November, 1941. Shipments in November were 127,052 tons, compared with 182,593 tons the preceding year. However, fabricators have 566,581 tons available for future fabrication.

Prices start the new year with composites at the same level as a year ago, frozen by the Office of Price Administration. Finished steel composite is $56.73, semifinished steel $36, steelmaking pig iron $23.05 and steelmaking scrap $19.17.

COMPOSITE MARKET AVERAGES

	Jan. 2	Dec. 26	Dec. 19	One Month Ago Dec., 1942	Three Months Ago Oct., 1942	One Year Ago Jan., 1942	Five Years Ago Jan., 1938
Finished Steel	$56.73	$56.73	$56.73	$56.73	$56.73	$56.73	$62.18
Semifinished Steel	36.00	36.00	36.00	36.00	36.00	36.00	40.00
Steelmaking Pig Iron	23.05	23.05	23.05	23.05	23.05	23.05	22.92
Steelmaking Scrap	19.17	19.17	19.17	19.17	19.17	19.17	14.10

Finished Steel Composite:—Average of industry-wide prices on sheets, strip, bars, plates, shapes, wire, nails, tin plate, standard and line pipe. **Semifinished Steel Composite:**—Average of industry-wide prices on billets, slabs, sheet bars, skelp and wire rods. **Steelmaking Pig Iron Composite:**—Average of basic pig iron prices at Bethlehem, Birmingham, Buffalo, Chicago, Cleveland, Neville Island, Granite City and Youngstown. **Steelworks Scrap Composite:**—Average of No. 1 heavy melting steel prices at Pittsburgh, Chicago and eastern Pennsylvania.

COMPARISON OF PRICES

Representative Market Figures for Current Week; Average for Last Month, Three Months and One Year Ago

Finished Material

	Jan. 2, 1943	Dec. 1942	Oct. 1942	Jan. 1942
Steel bars, Pittsburgh	2.15c	2.15c	2.15c	2.15c
Steel bars, Chicago	2.15	2.15	2.15	2.15
Steel bars, Philadelphia	2.49	2.49	2.49	2.47
Shapes, Pittsburgh	2.10	2.10	2.10	2.10
Shapes, Philadelphia	2.22	2.22	2.22	2.22
Shapes, Chicago	2.10	2.10	2.10	2.10
Plates, Pittsburgh	2.10	2.10	2.10	2.10
Plates, Philadelphia	2.15	2.15	2.15	2.15
Plates, Chicago	2.10	2.10	2.10	2.10
Sheets, hot-rolled, Pittsburgh	2.10	2.10	2.10	2.10
Sheets, cold-rolled, Pittsburgh	3.05	3.05	3.05	3.05
Sheets, No. 24 galv., Pittsburgh	3.50	3.50	3.50	3.50
Sheets, hot-rolled, Gary	2.10	2.10	2.10	2.10
Sheets, cold-rolled, Gary	3.05	3.05	3.05	3.05
Sheets, No. 24 galv., Gary	3.50	3.50	3.50	3.50
Bright bess., basic wire, Pittsburgh	2.60	2.60	2.60	2.60
Tin plate, per base box, Pittsburgh	$5.00	$5.00	$5.00	$5.00
Wire nails, Pittsburgh	2.55	2.55	2.55	2.55

Semifinished Material

Sheet bars, Pittsburgh, Chicago	$34.00	$34.00	$34.00	$34.00
Slabs, Pittsburgh, Chicago	34.00	34.00	34.00	34.00
Rerolling billets, Pittsburgh	34.00	34.00	34.00	34.00
Wire rods No. 5 to ⅜-inch, Pittsburgh	2.00	2.00	2.00	2.00

Pig Iron

	Jan. 2, 1943	Dec. 1942	Oct. 1942	Jan. 1942
Bessemer, del. Pittsburgh	$25.19	$25.19	$25.19	$25.19
Basic, Valley	23.50	23.50	23.50	23.50
Basic, eastern, del. Philadelphia	25.39	25.39	25.39	25.34
No. 2 fdry., del. Pgh., N.&S. Sides	24.69	24.69	24.69	24.69
No. 2 foundry, Chicago	24.00	24.00	24.00	24.00
Southern No. 2, Birmingham	20.38	20.38	20.38	20.38
Southern No. 2, del. Cincinnati	24.30	24.30	24.30	24.06
No. 2X, del. Phila. (differ. av.)	26.265	26.265	26.265	26.215
Malleable, Valley	24.00	24.00	24.00	24.00
Malleable, Chicago	24.00	24.00	24.00	24.00
Lake Sup., charcoal, del. Chicago	31.54	31.54	31.54	31.34
Gray forge, del. Pittsburgh	24.19	24.19	24.19	24.19
Ferromanganese, del. Pittsburgh	140.65	140.65	140.65	125.33

Scrap

Heavy melting steel, Pitts.	$20.00	$20.00	$20.00	$20.00
Heavy melt. steel, No. 2, E. Pa.	18.75	18.75	18.75	18.75
Heavy melting steel, Chicago	18.75	18.75	18.75	18.75
Rails for rolling, Chicago	22.25	22.25	22.25	22.25
No. 1 cast, Chicago	20.00	20.00	20.00	20.00

Coke

Connellsville, furnace, ovens	$6.00	$6.00	$6.00	$6.20
Connellsville, foundry, ovens	7.25	7.25	7.25	7.25
Chicago, by-product fdry., del.	12.25	12.25	12.25	12.25

STEEL, IRON, RAW MATERIAL, FUEL AND METALS PRICES

Following are maximum prices established by OPA Schedule No. 6 issued April 16, 1941, revised June 20, 1941 and Feb. 4, 1942. The schedule covers all iron or steel ingots, all semifinished iron or steel products, all finished hot-rolled, cold-rolled iron or steel products and any iron or steel product which is further finished by galvanizing, plating, coating, drawing, extruding, etc., although only principal established basing points for selected products are named specifically. All seconds and off-grade products also are covered. Exceptions applying to individual companies are noted in the table. Federal tax on freight charges, effective Dec. 1, 1942, not included in following prices.

Semifinished Steel

Gross ton basis except wire rods, skelp.

Carbon Steel Ingots: F.o.b. mill base, rerolling qual., stand. analysis, $31.00.
(Empire Sheet & Tin Plate Co., Mansfield, O., may quote carbon steel ingots at $33 gross ton, f.o.b. mill.)

Alloy Steel Ingots: Pittsburgh base, uncropped, $45.00.

Rerolling Billets, Slabs: Pittsburgh, Chicago, Gary, Cleveland, Buffalo, Sparrows Point, Birmingham, Youngstown, $34.00; Detroit, del. $36.25; Duluth (bil.) $36.00.
(Wheeling Steel Corp. allocated 21,000 tons 2" square, base grade rerolling billets under lease-lend during first quarter 1942 at $37, f.o.b. Portsmouth, O.; Andrews Steel Co. may quote carbon steel slabs $41 gross ton at established basing points.)

Forging Quality Billets: Pittsburgh, Chicago, Gary, Cleveland, Buffalo, Birmingham, Youngstown, $40.00; Detroit, del. $42.25; Duluth, $42.00.
(Andrews Steel Co. may quote carbon forging billets $50 gross ton at established basing points.)

Open Hearth Shell Steel: Pittsburgh, Chicago, base 1000 tons one size and section: 3-12 in., $52.00; 12-18 in., $54.00; 18 in. and over, $56.00.

Alloy Billets, Slabs, Blooms: Pittsburgh, Chicago, Buffalo, Bethlehem, Canton, Massillon, $54.00.

Sheet Bars: Pittsburgh, Chicago, Cleveland, Buffalo, Canton, Sparrows Point, Youngstown, $34.00.
(Empire Sheet & Tin Plate Co., Mansfield, O., may quote carbon steel sheet bars at $39 gross ton, f.o.b. mill.)

Skelp: Pittsburgh, Chicago, Sparrows Pt., Youngstown, Coatesville, lb., $1.90.

Wire Rods: Pittsburgh, Chicago, Cleveland, Birmingham, No. 5—9/32 in., inclusive, per 100 lbs., $2.00.
Do., over 9/32—47/64-in., incl., $2.15. Worcester add $0.10 Galveston, $0.27. Pacific Coast $0.50 on water shipment.

Bars

Hot-Rolled Carbon Bars: Pittsburgh, Chicago, Gary, Cleveland, Buffalo, Birmingham, base 20 tons one size, 2.15c; Duluth, base 2.25c; Detroit, del. 2.27c; New York del. 2.51c; Phila. del. 2.49c; Gulf Ports, dock 2.52c, all-rail 2.59c; Pac. ports, dock 2.80c; all rail 3.25c.
(Phoenix Iron Co., Phoenixville, Pa., may quote 2.35c at established basing points.)
Joslyn Mfg. Co. may quote 2.35c, Chicago base. Calumet Steel Division, Borg Warner Corp., may quote 2.35c, Chicago base, on bars produced on its 8-inch mill.)

Rail Steel Bars: Same prices as for hot-rolled carbon bars except base is 5 tons.
(Sweet's Steel Co., Williamsport, Pa., may quote rail steel merchant bars 2.33c f.o.b. mill.)

Hot-Rolled Alloy Bars: Pittsburgh, Chicago, Canton, Massillon, Buffalo, Bethhlehem, base 20 tons one size, 2.70c; Detroit, del., 2.82c.
(Texas Steel Co. may use Chicago base price as maximum f.o.b. Fort Worth, Tex., price on sales outside Texas, Oklahoma.)

AISI Series	(*Basic O-H)	AISI Series	(*Basic O-H)
1300	$0.10	4100 (.15-.25 Mo)	0.55
		(.20-.30 Mo)	0.60
2300	1.70	4340	1.70
2500	2.55	4600	1.20
3000	0.50	4800	2.15
3100	0.70	5100	0.35
3200	1.35	5130 or 5152	0.45
3400	3.20	6120 or 6152	0.95
4000	0.45-0.55	6145 or 6150	1.20

*Add 0.25 for acid open-hearth; 0.50 electric.

Cold-Finished Carbon Bars: Pittsburgh, Chicago, Gary, Cleveland, Buffalo, base 20,000-39,999 lbs., 2.65c; Detroit 2.70.

Cold-Finished Alloy Bars: Pittsburgh, Chicago, Gary, Cleveland, Buffalo, base 3.35c; Detroit, del. 3.47c.

Turned, Ground Shafting: Pittsburgh, Chicago, Gary, Cleveland, Buffalo, base (not including turning, grinding, polishing extras) 2.65c; Detroit 2.72c.

Reinforcing Bars (New Billet): Pittsburgh, Chicago, Gary, Cleveland, Birmingham, Sparrows Point, Buffalo, Youngstown, base 2.15c; Detroit del. 2.27c; Gulf ports, dock 2.52c, all-rail 2.61c; Pacific ports, dock 2.80c, all-rail 3.27c.

Reinforcing Bars (Rail Steel): Pittsburgh, Chicago, Gary, Cleveland, Birmingham, base 2.15c; Detroit, del. 2.27c; Gulf ports, dock 2.52c, all-rail 2.61c; Pacific ports, dock 2.80c, all-rail 3.25c.
(Sweet's Steel Co., Williamsport, Pa., may quote rail steel reinforcing bars 2.33c, f.o.b. mill.)

Iron Bars: Single refined, Pitts. 4.40c, double refined 5.40c; Pittsburgh, staybolt, 5.75c; Terre Haute, common, 2.15c.

Sheets, Strip

Hot-Rolled Sheets: Pittsburgh, Chicago, Gary, Cleveland, Birmingham, Buffalo, Youngstown, Sparrows Pt., Middletown, base 2.10c; Granite City, base 2.20c; Detroit del. 2.22c; Phila. del. 2.28c; New York del., 2.35c; Pacific ports 2.65c.
(Andrews Steel Co. may quote hot-rolled sheets for shipment to Detroit and the Detroit area on the Middletown, O. base.)

Cold-Rolled Sheets: Pittsburgh, Chicago, Cleveland, Gary, Buffalo, Youngstown, Middletown, base, 3.05c; Granite City, base 3.15c; Detroit del. 3.17c; New York del. 3.41c; Phila. del 3.39c; Pacific ports 3.70c.

Galvanized Sheets, No. 24: Pittsburgh, Chicago, Gary, Birmingham, Buffalo, Youngstown, Sparrows Point, Middletown, base 3.50c; Granite City, base 3.60c; New York del. 3.74c; Phila. del. 3.68c; Pacific ports 4.05c.
(Andrews Steel Co. may quote galvanized sheets 3.75c at established basing points.)

Corrugated Galv. Sheets: Pittsburgh, Chicago, Gary, Birmingham, 29 gage, per square 3.31c.

Culvert Sheets: Pittsburgh, Chicago, Gary, Birmingham, 16 gage, not corrugated, copper alloy 3.60c; copper iron 3.90c, pure iron 3.95c; zinc-coated, hot-dipped, heat-treated, No. 24, Pittsburgh 4.25c.

Enameling Sheets: Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Middletown, 10 gage.

base 2.75c; Granite City, base 2.85c; Pacific ports 3.40c.
Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Middletown, 20 gage, base 3.35c; Granite City, base 3.45c; Pacific ports 4.00c.

Electrical Sheets, No. 24:

	Pittsburgh Base	Pacific Ports	Granite City
Field grade	3.20c	3.95c	3.30c
Armature	3.35c	4.30c	3.65c
Electrical	4.05c	4.80c	4.15c
Motor	4.95c	5.70c	5.05c
Dynamo	5.65c	6.40c	5.75c
Transformer			
72	6.15c	6.90c	.....
65	7.15c	7.90c	.....
58	7.65c	8.40c	.....
52	8.45c	9.20c	.....

Hot-Rolled Strip: Pittsburgh, Chicago, Gary, Cleveland, Birmingham, Youngstown, Middletown, base, 1 ton and over, 12 inches wide and less 2.10c; Detroit del. 2.22c; Pacific ports 2.75c. (Joslyn Mfg. Co. may quote 2.30c, Chicago base.)

Cold Rolled Strip: Pittsburgh, Cleveland, Youngstown, 0.25 carbon and less 2.80c; Chicago, base 2.90c; Detroit, del. 2.92c; Worcester base 3.00c.

Commodity C. R. Strip: Pittsburgh, Cleveland, Youngstown, base 3 tons and over, 2.95c; Worcester base 3.35c.

Cold-Finished Spring Steel: Pittsburgh, Cleveland bases, add 20c for Worcester; .26-.50 Carb., 2.80c; .51-.75 Carb., 4.30c; .76-1.00 Carb., 6.15c; over 1.00 Carb., 8.35c.

Tin, Terne Plate

Tin Plate: Pittsburgh, Chicago, Gary, 100-lb. base box, $5.00; Granite City $5.10.

Tin Mill Black Plate: Pittsburgh, Chicago, Gary, base 29 gage and lighter, 3.05c; Granite City, 3.15c; Pacific ports, boxed 4.05c.

Long Ternes: Pittsburgh, Chicago, Gary, No. 24 unassorted 3.80c.

Manufacturing Ternes: (Special Coated) Pittsburgh, Chicago, Gary, 100-base box $4.30; Granite City $4.40.

Roofing Ternes: Pittsburgh base per package 112 sheets, 20 x 28 in., coating I.C., 8-lb. $12.00; 15-lb. $14.00; 20-lb. $15.00; 25-lb. $16.00; 30-lb. $17.25; 40-lb. $19.50.

Plates

Carbon Steel Plates: Pittsburgh, Chicago, Gary, Cleveland, Birmingham, Youngstown, Sparrows Point, Coatesville, Claymont, 2.10c; New York, del., 2.30-2.55c; Phila., del., 2.15c; St. Louis, 2.34c; Boston, del., 2.42-67c; Pacific ports, 2.65c; Gulf Ports, 2.47c.
(Granite City Steel Co. may quote carbon plates 2.35c, f.o.b. mill. Central Iron & Steel Co. may quote plates at 2.20c, f.o.b. basing points.)

Floor Plates: Pittsburgh, Chicago, 3.35c; Gulf ports, 3.72c; Pacific ports, 4.00c.

Open-Hearth Alloy Plates: Pittsburgh, Chicago, Coatesville, 3.50c.

Wrought Iron Plates: Pittsburgh, 3.80c.

Shapes

Structural shapes: Pittsburgh, Chicago, Gary, Birmingham, Buffalo, Bethlehem, 2.10c; New York, del., 2.28c; Phila., del., 2.22c; Gulf ports, 2.47c; Pacific ports, 2.75c.
(Phoenix Iron Co., Phoenixville, Pa. may quote carbon steel shapes at 2.30c at established basing points and 2.50c, Phoenixville, for export.)

Steel Sheet Piling: Pittsburgh, Chicago, Buffalo, 2.40c.

Wire Products, Nails

Wire: Pittsburgh, Chicago, Cleveland, Birmingham (except spring wire) to manufacturers in carloads (add $2 for Worcester):

Bright basic, bessemer wire	2.60c
Galvanized wire	2.60c
Spring wire	3.20c
Wire Products to the Trade:	
Standard and cement-coated wire nails, polished and staples, 100-lb. keg	$2.55
Annealed fence wire, 100 lb.	3.05
Galvanized fence wire, 100 lb.	3.40
Woven fence, 12½ gage and lighter, per base column	.67
Do., 11 gage and heavier	.70
Barbed wire, 80-rod spool, col.	.70
Twisted barbless wire, col.	.70
Single loop bale ties, col.	.50
Fence posts, carloads, col.	.69
Cut nails, Pittsburgh, carloads	$3.85

Pipe, Tubes

Welded Pipe: Base price in carloads to consumers about $200 per net ton. Base discounts on steel pipe Pittsburgh and Lorain, O.; Gary, Ind. 2 points less on lap weld, 1 point less on butt weld. Pittsburgh base only on wrought iron pipe.

	Butt Weld Steel			Iron	
In.	Blk.	Galv.	In.	Blk.	Galv.
⅛	56	33	¼	24	3½
¼ & ⅜	59	40½	⅜	30	10
½	63½	51	1-1¼	34	16
⅝	66½	56	1½	38	18½
1-3	68½	57½	2	37½	18

	Lap Weld Steel			Iron	
In.	Blk.	Galv.	In.	Blk.	Galv.
2	61	49½	1¼	23	3½
2½-3	64	52½	1½	28½	10
3½-6	66	54½	2	30½	12
7-8	65	52½	2½, 3½	31½	14½
9-10	64½	52	4	33½	18
11-12	63½	51	4½-8	32½	17
			9-12	28½	12

Boiler Tubes: Net base prices per 100 feet, f.o.b. Pittsburgh in carload lots, minimum wall, cut lengths 4 to 24 feet, inclusive.

O. D. Sizes	B.W.G.	—Seamless— Hot Rolled	Cold Drawn	—Lap Weld— Steel	Charcoal Iron
1"	13	$ 7.82	$ 9.01	.....	.....
1¼"	13	9.26	10.67	.....	.....
1½"	13	10.23	11.72	$ 9.72	$23.71
1¾"	13	11.64	13.42	11.06	22.93
2"	13	13.04	15.03	12.38	19.35
2¼"	13	14.54	16.76	13.79	21.63
2¼"	12	16.01	18.45	15.16	.....
2½"	12	17.54	20.21	16.58	26.57
2¾"	12	18.59	21.42	17.54	29.00
3"	12	19.50	22.48	18.35	31.38
3½"	11	24.63	28.37	23.15	39.81
4"	10	30.54	35.20	28.66	49.90
4½"	10	37.35	43.04	35.22	.....
5"	9	46.87	54.01	44.25	73.93
6"	7	71.96	82.93	68.14	.....

Rails, Supplies

Standard rails, over 60-lb., f.o.b. mill, gross ton, $40.00.
Light rails (billet), Pittsburgh, Chicago, Birmingham, gross ton, $40.00.
*Relaying rails, 35 lbs. and over, f.o.b. railroad and basing points, $28-$30.
Supplies: Angle bars, 2.70c; tie plates, 2.15c; track spikes, 3.00c; track bolts, 4.75c; do. heat treated, 5.00c.

*Fixed by OPA Schedule No. 46, Dec. 15, 1941.

Tool Steels

Tool Steels: Pittsburgh, Bethlehem, Syracuse, base, cents per lb.: Reg. carbon 14.00c; extra carbon 18.00c; special carbon 22.00c; oil-hardening 24.00c; high car.-chr. 43.00c.

High Speed Tool Steels:

Tung.	Chr.	Van.	Moly.	Pitts. base, per lb.
18.00	4	1	-	67.00c
1.5	4	1	8.5	54.00c
	4	2	8	54.00c
5.50	4	1.50	4	57.50c
5.50	4.50	4	4.50	70.00c

Stainless Steels

Base, Cents per lb.—f.o.b. Pittsburgh

Type	Bars	Plates	Sheets	H. R. Strip	C. R. Strip
CHROMIUM NICKEL STEEL					
302	24.00c	27.00c	34.00c	21.50c	28.00c
303	26.00	29.00	36.00	27.00	33.00
304	25.00	29.00	36.00	23.50	30.00
308	29.00	34.00	41.00	28.50	35.00
309	36.00	40.00	47.00	37.00	47.00
310	49.00	52.00	53.00	48.75	56.00
311	49.00	52.00	53.00	48.75	56.00
312	36.00	40.00	49.00	.....	.....
*316	40.00	44.00	48.00	40.00	48.00
*317	50.00	54.00	58.00	50.00	58.00
†321	29.00	34.00	41.00	29.25	38.00
‡347	33.00	38.00	45.00	33.00	42.00
431	19.00	22.00	29.00	17.50	22.50
STRAIGHT CHROMIUM STEEL					
403	21.50	24.50	29.50	21.25	27.00
**410	18.50	21.50	26.50	17.00	22.00
416	19.00	22.00	27.00	18.25	23.50
††420	24.00	28.50	33.50	23.75	36.50
430	19.00	22.00	29.00	17.50	22.50
‡‡430F	19.50	22.50	29.50	18.75	24.50
442	22.50	25.50	32.50	24.00	32.00
446	27.50	30.50	36.50	35.00	52.00
501	8.00	12.00	15.75	12.00	17.00
502	9.00	13.00	16.75	13.00	18.00
STAINLESS CLAD STEEL (20%)					
304	.....	‡‡18.00	19.00	.....	.....

*With 2-3% moly. †With titanium. ‡With columbium. **Plus machining agent. ††High carbon. ‡‡Free machining. ‡‡Includes annealing and pickling.

Basing Point Prices are (1) those announced by U. S. Steel Corp. subsidiaries for first quarter of 1941 or in effect April 16, 1941 at designated basing points or (2) those prices announced or customarily quoted by other producers at the same designated points. Base prices under (2) cannot exceed those under (1) except to the extent prevailing in third quarter of 1940.

Extras mean additions or deductions from base prices in effect April 16, 1941.

Delivered prices applying to Detroit, Eastern Michigan, Gulf and Pacific Coast points are deemed basing points except in the case of the latter two areas when water transportation is not available, in which case nearest basing point price, plus all-rail freight may be charged.

Domestic Ceiling prices are the aggregate of (1) governing basing point price, (2) extras and (3) transportation charges to the point of delivery as customarily computed. **Governing basing point** is basing point nearest the consumer providing the lowest delivered price. **Emergency basing point** is the basing point at or near the place of production or origin.

Seconds, maximum prices: flat-rolled rejects 75% of prime prices; wasters 75%, waste-wasters 65%, except plates, which take waster prices; tin plate $2.80 per 100 lbs.; terne plate $2.25; semifinished 85% of primes; other grades limited to new material ceilings.

Export ceiling prices may be either the aggregate of (1) governing basing point or emergency basing point (2) export extras (3) export transportation charges provided they are the f.a.s. seaboard quotations of the U. S. Steel Export Co. on April 16, 1941.

Bolts, Nuts

F.o.b. Pittsburgh, Cleveland, Birmingham, Chicago. Discounts for carloads additional 5%, full containers, add 10%.

Carriage and Machine

½ x 6 and smaller	65½ off
Do., ⅝ and ⅞ x 6-in. and shorter	63½ off
Do., 1 x 6-in. and shorter	61 off
1¼ and larger, all lengths	59 off
All diameters, over 6-in. long	50 off
Tire bolts	50 off
Step bolts	56 off
Plow bolts	65 off

Stove Bolts

In packages with nuts separate 71-10 off; with nuts attached 71 off; bulk 80 off on 15,000 of 3-inch and shorter, or 5000 over 3-in.

Nuts

	U.S.S.	S.A.E.
Semifinished hex.		
⅞-inch and less	62	64
1-inch	59	60
1⅛-1½-inch	57	58
1⅝ and larger	56	..

Hexagon Cap Screws

Upset 1-in., smaller	64 off
Milled 1-in., smaller	60 off

Square Head Set Screws

Upset, 1-in., smaller	71 off
Headless, ¼-in., larger	60 off
No. 10, smaller	70 off

Piling

Pittsburgh, Chicago, Buffalo 2.40c

Rivets, Washers

F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham

Structural	3.75c
⅞-inch and under	65-5 off
Wrought washers, Pittsburgh, Chicago, Philadelphia, to jobbers and large nut, bolt manufacturers l.c.l.	$2.75-3.00 off

Metallurgical Coke

Price Per Net Ton

Beehive Ovens	
Connellsville, furnace	*$6.00
Connellsville, foundry	7.00- 7.50
Connellsville prem. fdry.	7.25- 7.60
New River, foundry	8.00- 8.25
Wise county, foundry	7.50
Wise county, furnace	6.50
By-Product Foundry	
Kearny, N. J., ovens	12.15
Chicago, outside delivered	11.50
Chicago, delivered	12.25
Terre Haute, delivered	12.00
Milwaukee, ovens	12.25
New England, delivered	13.75
St. Louis, delivered	†12.25
Birmingham, ovens	8.50
Indianapolis, delivered	12.00
Cincinnati, delivered	11.75
Cleveland, delivered	12.30
Buffalo, delivered	12.50
Detroit, delivered	12.25
Philadelphia, delivered	12.38

*Operators of hand-drawn ovens using trucked coal may charge $6.50, effective Aug. 12, 1942. †$12.75 from other than Ala., Mo., Tenn.

Coke By-Products

Spot, gal., freight allowed east of Omaha

Pure and 90% benzol	15.00c
Toluol, two degree	28.00c
Solvent naphtha	27.00c
Industrial xylol	27.00c
Per lb. f.o.b. works	
Phenol (car lots, returnable drums)	12.50c
Do. less than car lots	13.25c
Do. tank cars	11.50c
Eastern Plants, per lb.	
Naphthalene flakes, balls, bbls., to jobbers	8.00c
Per ton, bulk, f.o.b. port	
Sulphate of ammonia	$29.20

Pig Iron

Prices (in gross tons) are maximums fixed by OPA Price Schedule No. 10, effective June 10, 1941. Exceptions indicated in footnotes. Allocation regulations from WPB Order M-17, expiring Dec. 31, 1942. Base prices bold face, delivered light face. Federal tax on freight charges, effective Dec. 1, 1942, not included in following prices.

	No. 2 Foundry	Basic	Bessemer	Malleable
Bethlehem, Pa., base	$25.00	$24.50	$26.00	$25.50
Newark, N. J., del.	26.62	26.12	27.62	27.12
Brooklyn, N. Y., del.	27.63	.....	.....	28.15
Birdsboro, Pa., del.	25.00	24.50	26.00	25.50
Birmingham, base	†20.38	†19.00	.....	.....
Baltimore, del.	25.67	.....	.....	.....
Boston, del.	25.12	.....	.....	.....
Chicago, del.	‡24.47	.....	.....	.....
Cincinnati, del.	24.30	22.92	.....	.....
Cleveland, del.	24.12	23.24	.....	.....
Newark, N. J., del.	26.24	.....	.....	.....
Philadelphia, del.	25.51	25.01	.....	.....
St. Louis, del.	‡24.12	23.24	.....	.....
Buffalo, base	24.00	23.00	25.00	24.50
Boston, del.	25.50	25.00	26.50	26.00
Rochester, del.	25.53	.....	26.53	26.03
Syracuse, del.	26.08	.....	27.08	26.58
Chicago, base	24.00	23.50	24.50	24.00
Milwaukee, del.	25.17	24.67	25.67	25.17
Muskegon, Mich., del.	27.38	.....	.....	27.38
Cleveland, base	24.00	23.50	24.50	24.00
Akron, Canton, O., del.	25.47	24.97	25.97	25.47
Detroit, base	24.00	23.50	24.50	24.00
Saginaw, Mich., del.	26.45	25.95	26.95	26.45
Duluth, base	24.50	24.00	25.00	24.50
St. Paul, del.	26.76	26.26	27.26	26.76
Erie, Pa., base	24.00	23.50	25.00	24.50
Everett, Mass., base	25.00	24.50	26.00	25.50
Boston	25.50	25.00	26.50	26.00
Granite City, Ill., base	24.00	23.50	24.50	24.00
St. Louis, del.	24.50	24.00	.....	24.50
Hamilton, O., base	24.00	23.50	.....	24.00
Cincinnati, del.	24.68	24.68	.....	25.35
Neville Island, Pa., base	24.00	23.50	24.50	24.00
†Pittsburgh, del., No. & So. sides	24.69	24.19	25.19	24.69
Provo, Utah, base	22.00	.....	.....	.....
Sharpsville, Pa., base	24.00	23.50	24.50	24.00
Sparrows Point, Md., base	25.00	24.50	.....	.....
Baltimore, del.	26.05	.....	.....	.....
Steelton, Pa., base	.....	24.50	.....	25.50
Swedeland, Pa., base	25.00	24.50	26.00	25.50
Philadelphia, del.	25.89	25.39	.....	26.39
Toledo, O., base	24.00	23.50	24.50	24.00
Mansfield, O., del.	26.06	25.56	26.56	26.06
Youngstown, O., base	24.00	23.50	24.50	24.00

*Basic silicon grade (1.75-2.25%), add 50c for each 0.25%. †For phosphorus 0.70 and over deduct 38c. ‡Over 0.70 phos. §For McKees Rocks, Pa., add .55 to Neville Island base; Lawrenceville, Homestead, McKeesport, Ambridge, Monaca, Aliquippa, .84; Monessen, Monongahela City .97 (water); Oakmont, Verona 1.11; Brackenridge 1.24.

High Silicon, Silvery

6.00-6.50 per cent (base)	$29.50		
6.51-7.00	$30.50	9.01- 9.50	$35.50
7.01-7.50	31.50	9.51-10.00	36.50
7.51-8.00	32.50	10.01-10.50	37.50
8.01-8.50	33.50	10.51-11.00	38.50
8.51-9.00	34.50	11.01-11.50	39.50

F.o.b. Jackson county, O., per gross ton, Buffalo base prices are $1.25 higher. Prices subject to additional charge of 50 cents a ton for each 0.50% manganese in excess of 1.00%.

Bessemer Ferrosilicon

Prices same as for high silicon silvery iron, plus $1 per gross ton. (For higher silicon irons a differential over and above the price of base grades is charged as well as for the hard chilling irons, Nos. 5 and 6.)

Charcoal Pig Iron

Northern

Lake Superior Furn. $28.00
Chicago, del. 31.54

Southern

Semi-cold blast, high phos., f.o.b. furnace, Lyles, Tenn. $28.50
Semi-cold blast, low phos., f.o.b. furnace, Lyles, Tenn. 33.00

Gray Forge

Neville Island, Pa. $23.50
Valley, base 23.50

Low Phosphorus

Basing points: Birdsboro and Steelton, Pa., and Buffalo, N. Y., $29.50 base; $30.81, delivered, Philadelphia.

Switching Charges: Basing point prices are subject to an additional charge for delivery within the switching limits of the respective districts.

Silicon Differentials: Basing point prices are subject to an additional charge not to exceed 50 cents a ton for each 0.25 silicon in excess of base grade (1.75 to 2.25%).

Phosphorous Differential: Basing point prices are subject to a reduction of 38 cents a ton for phosphorous content of 0.70% and over.

Manganese Differentials: Basing point prices subject to an additional charge not to exceed 50 cents a ton for each 0.50% manganese content in excess of 1.0%.

Ceiling prices are the aggregate of (1) governing basing point (2) differentials (3) transportation charges from governing basing point to point of delivery as customarily computed. Governing basing point is the one resulting in the lowest delivered price for the consumer.

Exceptions to Ceiling Prices: Pittsburgh Coke & Iron Co. (Sharpsville, Pa. furnace only) and Struthers Iron & Steel Co. may charge 50 cents a ton in excess of basing point prices for No. 2 Foundry, Basic, Bessemer and Malleable. Mystic Iron Works, Everett, Mass., may exceed basing point prices by $1 per ton, effective April 20, 1942. Chester, Pa., furnace of Pittsburgh Coke & Iron Co. may exceed basing point prices by $2.25 per ton, effective July 27, 1942.

Refractories

Refractories

Per 1000 f.o.b. Works, Net Prices

Fire Clay Brick

Super Quality

Pa., Mo., Ky. $64.60

First Quality

Pa., Ill., Md., Mo., Ky.	51.30
Alabama, Georgia	51.30
New Jersey	56.00
Ohio	43.00

Second Quality

Pa., Ill., Md., Mo., Ky.	46.55
Alabama, Georgia	38.00
New Jersey	49.00
Ohio	36.00

Malleable Bung Brick

All bases $59.85

Silica Brick

Pennsylvania	$51.30
Joliet, E. Chicago	58.90
Birmingham, Ala.	51.30

Ladle Brick

(Pa., O., W. Va., Mo.)

Dry press	$31.00
Wire cut	29.00

Magnesite

Domestic dead-burned grains, net ton f.o.b. Chewelah, Wash., net ton, bulk	22.00
net ton, bags	26.00

Basic Brick

Net ton, f.o.b. Baltimore, Plymouth Meeting, Chester, Pa.

Chrome brick	$54.00
Chem. bonded chrome	54.00
Magnesite brick	76.00
Chem. bonded magnesite	65.00
Fluorspar	

Fluorspar

Washed gravel, f.o.b. Ill., Ky., net ton, carloads, all rail	$25.00-28.00
Do., barge	25.00-28.00
No. 2 lump	25.00-28.00

(Prices effective Nov. 23, 1942)

Ferroalloy Prices

Ferromanganese: 78-82%, carlots, gross ton, duty paid, Atlantic ports, $135; Del. Pittsburgh $140.65; f.o.b. Southern furnaces $135; Add $6 per gross ton for packed carloads $10 for ton, $13.50 for less-ton and $18 for less than 200-lb. lots, packed.

Spiegeleisen: 19-21%, carlots per gross ton, Palmerton, Pa. $36.

Electrolytic manganese: 99.9% plus, less ton lots, per lb. 42.00c. Ton lots 40.00c. Annual contracts 38.00c.

Chromium Metal: Per lb. contained chromium in gross ton lots, contract basis, freight allowed, 98% 80.00c, 88% 79.00c. Spot prices 5 cents per lb. higher.

Ferrocolumbium: 50-60%, per lb. contained columbium in gross ton lots, contract basis, f.o.b. Niagara Falls, N. Y. $2.25; less-ton lots $2.30. Spot prices 10 cents per lb. higher.

Ferrochrome: 66-70%; per lb. contained chromium in carloads, freight allowed, 4-6% carbon 13.00c; ton lots 13.75c; less-ton lots 14.00c; less than 200-lb. lots 14.25c. 66-72%, low carbon grades:

	Car loads	Ton lots	Less ton	Less 200 lbs.
2% C.	19.50c	20.25c	20.75c	21.00c
1% C.	20.50c	21.25c	21.75c	22.00c
0.20% C.	21.50c	22.25c	22.75c	23.00c
0.10% C.	22.50c	23.25c	23.75c	24.00c

Spot is ¼c higher

Chromium briquets: Contract basis in carloads per lb., freight allowed 8.25c; packed 8.50c; gross ton lots 8.75c; less-ton lots 9.00c; less 200-lb. lots 9.25c. Spot prices ¼-cent higher.

Ferromolybdenum: 55-75%, per lb. contained molybdenum, f.o.b. Langeloth and Washington, Pa., furnace, any quantity 95.00c.

Calcium Molybdate (Molyte): 40-45%, per lb. contained molybdenum, contract basis, f.o.b. Langeloth and Washington, Pa., any quantity, 80.00c.

Molybdic Oxide Briquets: 48-52%, per lb. contained molybdenum, f.o.b. Langeloth, Pa., any quantity 80.00c.

Molybdenum Oxide: 53-63%, per lb. contained molybdenum in 5 and 20 lb. molybdenum contained cans, f.o.b. Langeloth and Washington, Pa., any quantity 80.00c.

Molybdenum Powder: 99% per lb. in 200-lb. kegs, f.o.b. York, Pa. $2.60; 100-200 lb. lots $2.75; under 100-lb. lots $3.00.

Ferrophosphorus: 17-19%, based on 18% phosphorus content, with unitage of $3 for each 1% of phosphorus above or below the base; gross tons per carload f.o.b. sellers' works, with freight equalized with Rockdale, Tenn.; contract price $58.50, spot $62.25.

Ferrophosphorus: 23-26%, based on 24% phosphorus content, with unitage of $3 for each 1% of phosphorus above or below the base; gross tons per carload f.o.b. sellers' works, with freight equalized with Mt. Pleasant, Tenn.; contract price $75, spot $80.

Ferrosilicon: Contract basis in gross tons per carload, bulk, freight allowed; unitage applies to each 1% silicon above or below base.

	Carloads	Ton lots
50%	$ 74.50	$ 87.00
Unitage	1.50	1.75
75%	135.00	151.00
Unitage	1.80	2.00
85%	170.00	188.00
Unitage	2.00	2.20
90-95%	10.25c	11.25c

Spot prices ¼-cent higher.

Silicon Metal: Contract basis per lb., f.o.b. producers' plants, freight allowed; 1% iron; carlots 14.50c, ton lots 15.00c, less-ton lots 15.25c, less 200 lbs. 15.50c.

Silicon Metal: Contract basis per lb.; 2% iron; carlots 13.00c, ton lots 13.50c, less-ton lots 13.75c, less 200 lbs. 14.00c. Spot prices ¼-cent higher.

Silicon Briquets: Contract basis; in carloads, bulk freight allowed, per ton $74.50; packed $80.50; ton lots $84.50; less-ton lots per lb. 4.00c; less 200-lb. lots per lb. 4.25c. Spot ¼-cent per lb. higher on less-ton lots; $5 per ton higher on ton lots and over.

Silicomanganese: Contract basis freight allowed, 1½% carbon; in carloads per gross ton $135; ton lots $147.50. Spot $5 per ton higher.

Silico-manganese Briquets: Contract basis in carloads per pound, bulk freight allowed 5.80c; packed 6.05c; ton lots 6.30c; less-ton lots 6.55c; less 200-lb. lots 6.80c. Spot prices ¼-cent higher.

Ferrotungsten: Carlots, per lb. contained tungsten, $1.90.

Tungsten Metal Powder: 98-99%, per lb. any quantity $2.55-2.65.

Ferrotitanium: 40-45%, f.o.b. Niagara Falls, N. Y., per lb. contained titanium; ton lots $1.23; less-ton lots $1.25. Spot 5 cents per lb. higher.

Ferrotitanium: 20-25%, 0.10 maximum carbon; per lb. contained titanium; ton lots $1.35; less-ton lots $1.40. Spot 5 cents per lb. higher.

High-Carbon Ferrotitanium: 15-20%, Contract basis, per gross ton, f.o.b. Niagara Falls, N. Y., freight allowed to destinations east of Mississippi River and North of Baltimore and St. Louis, 6-8% carbon $142.50; 3-5% carbon $157.50.

Ferrovanadium: 35-40%, contract basis, per lb. contained vanadium, f.o.b. producers plant with usual freight allowances; open-hearth grade $2.70; special grade $2.80; highly-special grade $2.90.

Vanadium Pentoxide: Technical grade, 88-92 per cent V_2O_5; contracts, any quantity, $1.10 per pound V_2O_5 contained; spot 5 cents per pound higher.

Zirconium Alloys: 12-15%, contract basis, carloads bulk, per gross ton $102.50; packed $107.50; ton lots $108; less-ton lots $112.50. Spot $5 per ton higher.

Zirconium alloy: 35-40%, contract basis, carloads in bulk or package, per lb. of alloy 14.00c; gross ton lots 15.00c; less-ton lots 16.00c. Spot ¼-cent higher.

Alsifer: (Approx. 20% aluminum, 40% silicon, 40% iron) Contract basis, f.o.b. Niagara Falls, N. Y., per lb. 7.50c; ton lots 8.00c. Spot ½-cent higher.

Simanal: (Approx. 20% each silicon, manganese, aluminum) Contract basis, freight allowed, per lb. of alloy; carlots 10.50c; ton lots 11.00c, less ton lots, 11.50c.

WAREHOUSE STEEL PRICES

Base Prices in Cents Per Pound, Delivered Locally, Subject to Prevailing Differentials. As of April 16, 1941

	Soft Bars	Hot-Rolled Strip Bands	Hot-Rolled Strip Hoops	Plates ¼-in. & Over	Structural Shapes	Floor Plates	Sheets: Hot Rolled	Sheets: Cold Rolled	Sheets: Galv. No. 24	Cold Rolled Strip	Cold Drawn Bars: Carbon	Cold Drawn Bars: S.A.E. 2300	Cold Drawn Bars: S.A.E. 3100
Boston	3.98	4.06	5.06	3.85	3.85	5.06	3.71	4.68	5.11	3.46	4.13	8.88	7.23
New York (Met.)	3.84	3.96	3.96	3.76	3.75	5.56	3.58	4.60	5.00	3.51	4.09	8.84	7.19
Philadelphia	3.85	3.95	4.45	3.55	3.55	5.25	3.55	4.05	4.65	3.31	4.06	8.56	7.16
Baltimore	3.85	4.00	4.35	3.70	3.70	5.25	3.50	....	5.05	....	4.04	....	....
Norfolk, Va.	4.00	4.10	....	4.05	4.05	5.45	3.85	....	5.40	....	4.15	....	....
Buffalo	3.35	3 82	3.82	3.62	3.40	5.25	3.25	4.30	4.75	3.52	3.75	8.40	6.75
Washington, D. C.	3.95	4.10	4.45	3.80	3.80	5.35	3.60	....	....	....	4.03	....	....
Pittsburgh	3.35	3.60	3.60	3.40	3.40	5.00	3.35	....	4.65	....	3.65	8.40	6.75
Cleveland	3.25	3.50	3.50	3.40	3.58	5.18	3.35	4.05	4.62	3.20	3.75	8.40	6.75
Detroit	3.43	3.43	3.68	3.60	3.65	5.27	3.42	4.30	4.84	3.40	3.80	8.70	7.05
Omaha	4.10	4.20	4.20	4.15	4.15	5.75	3.85	5.32	5.50	....	4.42	....	....
Cincinnati	3.60	3.67	3.67	3.65	3.68	5.28	3.42	4.37	4.92	3.45	4.00	8.75	7.10
Chicago	3.50	3.60	3.60	3.55	3.55	5.15	3.25	4.10	4.85	3.50	3.75	8.40	6.75
Twin Cities	3.75	3.85	3.85	3.80	3.80	5.40	3.50	4.35	5.00	3.83	4.34	9.09	7.44
Milwaukee	3.63	3.53	3.53	3.68	3.68	5.28	3.38	4.23	4.98	3.54	3.88	8.38	6.98
St. Louis	3.64	3.74	3.74	3.69	3.69	5.29	3.39	4.24	4.99	3.61	4.02	8.77	7.12
Indianapolis	3.60	3.75	3.75	3.70	3.70	5.30	3.45	....	5.01	....	3.97	....	....
Chattanooga*	3.80	4.00	4.00	3.85	3.85	5.80	3.75	....	4.50	....	4.39	....	....
Memphis	3.90	4.10	4.10	3.95	3.95	5.71	3.85	....	5.25	....	4.31	....	....
Birmingham	3.50	3.70	3.70	3.55	3.55	5.93	3.45	....	4.75	....	4.43	....	....
New Orleans	4.00	4.10	4.10	3.80	3.80	5.75	3.85	....	5.25	5.00	4.60	....	....
Houston, Tex.	3.75	4.30	4.30	4.05	4.05	5.50	4.00	....	5.25	....	6.90	....	....
Seattle	4.20	4.25	5.45	4.75	4.45	6.50	4.65	7.60	5.70	....	5.75	....	....
Los Angeles	4.35	4.90	6.70	4.90	4.60	7.15	4.95	7.15	5.95	....	6.10	10.55	9.55
San Francisco	3.95	4.50	6.25	4.65	4.35	6.35	4.55	6.40	6.10	....	6.80	10.80	9.80

*Not named in OPA price order.

	S.A.E. Hot-rolled Bars (Unannealed): 1035-1050	2300 Series	3100 Series	4100 Series	6100 Series
Boston	4.28	7.75	6.05	5.80	7.90
New York (Met.)	4.04	7.60	5.90	5.65	....
Philadelphia	4.10	7.56	5.86	5.61	8.56
Baltimore	4.45	....	....	....	....
Buffalo	3.55	7.35	5.65	5.40	7.50
Pittsburgh	3.40	7.45	5.75	5.50	7.60
Cleveland	3.30	7.55	5.85	5.85	7.70
Detroit	3.48	7.67	5.97	5.72	7.19
Cincinnati	3.65	7.69	5.99	5.74	7.84
Chicago	3.70	7.35	5.65	5.40	7.50
Twin Cities	3.95	7.70	6.00	6.09	8.19
Milwaukee	3.83	7.33	5.88	5.63	7.73
St. Louis	3.84	7.72	6.02	5.77	7.87
Seattle	6.25	....	8.00	7.85	8.65
Los Angeles	4.60	9.55	9.55	8.40	8.80
San Francisco	5.45	9.80	8.80	8.65	9.05

BASE QUANTITIES

Soft Bars, Bands, Hoops, Plates, Shapes, Floor Plates, Hot Rolled Sheets and SAE 1035-1050 Bars: Base, 400-1999 pounds; 300-1999 pounds in Los Angeles; 400-39,999 (hoops, 0-299) in San Francisco; 300-4999 pounds in Portland; 300-9999 Seattle; 400-14,999 pounds in Twin Cities; 400-3999 pounds in Birmingham, Memphis.

Cold Rolled Sheets: Base, 400-1499 pounds in Chicago, Cincinnati, Cleveland, Detroit, New York, Omaha, Kansas City, St. Louis; 450-3749 in Boston; 500-1499 in Buffalo; 1000-1999 in Philadelphia, Baltimore; 750-4999 in San Francisco; 300-4999 in Portland, Seattle; any quantity in Twin Cities, New Orleans; 300-1999 Los Angeles.

Galvanized Sheets: Base, 150-1499 pounds, New York; 150-1499 in Cleveland, Pittsburgh, Baltimore, Norfolk; 150-1049 in Los Angeles; 300-10,000 in Portland, Seattle; 450-3749 in Boston; 500-1499 in Birmingham, Buffalo, Chicago, Cincinnati, Detroit, Indianapolis, Milwaukee, Omaha, St. Louis, Tulsa; 3500 and over in Chattanooga; any quantity in Twin Cities; 750-1500 in Kansas City; 150 and over in Memphis; 25 to 49 bundles in Philadelphia; 750-4999 in San Francisco.

Cold Rolled Strip: No base quantity; extras apply on lots of all size.

Cold Finished Bars: Base, 1500 pounds and over on carbon, except 0-299 in San Francisco; 1 to 99, Los Angeles; 1000 and over in Portland, Seattle; 1000 pounds and over on alloy, except 0-4999 in San Francisco.

SAE Hot Rolled Alloy Bars: Base, 1000 pounds and over, except 0-4999. San Francisco; 0-1999, Portland, Seattle.

Ores

Lake Superior Iron Ore

Gross ton, 51½%

Lower Lake Ports

Old range bessemer	$4.75
Mesabi nonbessemer	4.45
High phosphorus	4.35
Mesabi bessemer	4.60
Old range nonbessemer	4.60

Eastern Local Ore

Cents, unit, del. E. Pa.

Foundry and basic 56-63%, contract	13.00

Foreign Ore

Cents per unit, c.i.f. Atlantic ports

Manganiferous ore, 45-55% Fe., 6-10% Mang.	Nom.
N. African low phos.	Nom.
Spanish, No. African basic, 50 to 60%	Nom.
Brazil iron ore, 68-69% f.o.b. Rio de Janeiro	7.50-8.00c

Tungsten Ore

Chinese wolframite, per short ton unit, duty paid	$24.00

Chrome Ore

(Equivalent OPA schedules):

Gross ton f.o.b. cars, New York, Philadelphia, Baltimore, Charleston, S. C., Portland, Ore., or Tacoma, Wash.

(S/S paying for discharging; dry basis; subject to penalties if guarantees are not met.)

Indian and African	
48% 2.8:1	41.00
48% 3:1	43.50
48% no ratio	31.00
South African (Transvaal)	
44% no ratio	27.40
45% no ratio	28.30
48% no ratio	31.00
50% no ratio	32.80
Brazilian—nominal	
44% 2.5:1 lump	33.05
48% 3:1 lump	43.50
Rhodesian	
45% no ratio	28.30
48% no ratio	31.00
48% 3:1 lump	43.50
Domestic (f.o.b. Columbus, Mont.)	
48% 3:1	43.50
less $7 freight allowance	

Manganese Ore

Including war risk but not duty, cents per gross-ton unit, dry, f.o.b. cars, New Orleans and Mobile; 5 cents higher at Norfolk, Baltimore, Philadelphia, New York; adjustments for analysis variations. (Based on OPA schedules.)

Brazilian, 48%	73.8c
Brazilian, 46%	71.8c
Caucasian, 51%	75.3c
Caucasian, 50%	74.8c
Chilean, 48%	73.8c
Indian, 50%	74.8c
Indian, 48%	73.8c
South African, 48%	73.8c
South African, 46%	71.8c
(Duty Free)	
Cuban, 51%	86.5c
Cuban, 48%	85.0c
Cuban, 45%	82.0c
Philippine, 50%	85.0c
Domestic, 48%, f.o.b. mines	96.0c

Molybdenum

Sulphide conc., lb., Mo. cont., mines	$0.75

NATIONAL EMERGENCY STEELS (Hot Rolled)

Extras for Alloy Content

Designation	Chemical Composition Limits, Per Cent: Carbon	Mn.	Si.	Cr.	Ni.	Mo.	Basic open-hearth: Bars per 100 lb.	Basic open-hearth: Billets per G T	Electric furnace: Bars per 100 lb.	Electric furnace: Billets per G T
NE 1330	.28-.33	1.60-1.90	.20-.35	.....	.....	.....	$ .10	$2.00	....	....
NE 8020	.18-.23	1.00-1.30	.20-.35	.....	.....	.10-.20	.45	9.00	$.95	$19.00
NE 8339	.35-.42	1.30-1.60	.20-.35	.....	.....	.20-.30	.75	15.00	1.25	25.00
NE 8442	.40-.45	1.30-1.60	.20-.35	.....	.....	.30-.40	.90	18.00	1.40	28.00
NE 8613	.12-.17	.70- .90	.20-.35	.40-.60	.40-.60	.15-.25	.75	15.00	1.25	25.00
NE 8720	.18-.18	.70- .90	.20-.35	.40-.60	.40-.70	.20-.30	.80	16.00	1.30	26.00
NE 8949	.45-.50	1.00-1.30	.20-.35	.40-.60	.40-.60	.30-.40	1.20	24.00	1.70	34.00
NE 9255	.50-.60	.75-1.00	1.80-2.20	.....	.....	.....	.40	8.00	....	....
NE 9262	.55-.65	.75-1.00	1.80-2.20	.20-.40	.....	.....	.65	13.00	....	....
NE 9415	.13-.18	.80-1.10	.40-.60	.20-.40	.20-.50	.08-.15	.80	16.00	1.30	26.00
NE 9442	.40-.45	1.00-1.30	.40-.60	.20-.40	.20-.50	.08-.15	.85	17.00	1.35	27.00
NE 9537	.35-.40	1.20-1.50	.40-.60	.40-.60	.40-.70	.15-.25	1.20	24.00	1.70	34.00
NE 9630	.28-.33	1.20-1.50	.40-.60	.40-.60	.....	.....	.80	16.00	1.30	26.00
NE 9642	.40-.45	1.30-1.60	.40-.60	.40-.60	.....	.....	.85	17.00	1.35	27.00

Extras are in addition to a base price of 2.70c, per 100 lb., on finished products and $54 per gross ton on semifinished steel major basing points and are in cents per 100 lb. and dollars per gross ton in semifinished. No prices quoted on vanadium alloy.

MAXIMUM PRICES FIXED BY OPA ON IRON AND STEEL SCRAP

Other than railroad grades quoted on the basis of basing point prices from which shipping point prices and consumers' delivered prices are to be computed. Scrap originating from railroads quoted delivered to consumers' plants located on the line of the railroad from which the material originated. All prices in gross tons. A basing point includes its switching district.

PRICES FOR OTHER THAN RAILROAD SCRAP

				Low Phos. Grades		ELECTRIC FURNACE AND FOUNDRY GRADES								
						Heavy Structural, Plate			Cut Auto Scrap					
	OPEN HEARTH GRADES*	Machine Shop Turnings	BLAST FURNACE GRADES*	Billet, Bloom Forge Crops	Bar Crops and smaller; Punchings, Plate	3 ft. and less	2 ft. and less	1 ft. and less	3 ft. and less	2 ft. and less	1 ft. and less	Alloy-Free Low Phos. & Sulphur Turnings	First Cut Heavy Axle & Forge Turnings	Electric Furnace Bundles
Pittsburgh, Brackenridge, Butler, Johnstown, Midland, Monessen, Sharon, Steubenville, Weirton, Canton, Youngstown, Warren	$20.00	$16.00	$16.00	$25.00	$22.50	$21.00	$21.50	$22.00	$20.00	$20.50	$21.00	$18.00	$19.50	$21.00
Claymont, Coatesville, Harrisburg, Conshohocken, Phoenixville	18.75	14.75	14.75	23.75	21.25	19.75	20.25	20.75	18.75	19.25	19.75	16.75	18.25	19.75
Bethlehem	18.25	14.25	14.25	23.25	20.75	19.25	19.75	20.25	18.25	18.75	19.25	16.25	17.75	19.25
Buffalo	19.25	15.25	15.25	24.25	21.75	20.25	20.75	21.25	19.25	19.75	20.25	17.25	18.75	20.25
Cleveland, Middletown, Cincinnati, Portsmouth, Ashland	19.50	15.50	15.50	24.50	22.00	20.50	21.00	21.50	19.50	20.00	20.50	17.50	19.00	20.50
Detroit	17.85	13.85	13.85	22.85	20.35	18.85	19.35	19.85	17.85	18.35	18.85	15.85	17.35	18.85
Toledo	..	13.85	13.85	..	..	..	..	..	..	..	..	..	..	..
Chicago	18.75	14.75	14.75	23.75	21.25	19.75	20.25	20.75	18.75	19.25	19.75	16.75	18.25	19.75
Kokomo	18.25	14.25	14.25	23.25	20.75	19.25	19.75	20.25	18.25	18.75	19.25	16.25	17.75	19.25
Duluth	18.00	14.00	14.00	23.00	20.50	19.00	19.50	20.00	18.00	18.50	19.00	16.00	17.50	19.00
St. Louis	17.50	13.50	13.50	22.50	20.00	18.50	19.00	19.50	17.50	18.00	18.50	15.50	17.00	18.50
Birmingham, Atlanta, Alabama City, Los Angeles, San Francisco, Pittsburg, Calif.	17.00	13.00	13.00	22.00	19.50	18.00	18.50	19.00	17.00	17.50	18.00	15.00	16.50	18.00
Minnequa, Colo.	16.50	12.50	12.50	21.50	19.00	17.50	18.00	18.50	16.50	17.00	17.50	14.50	16.00	17.50
Seattle	14.50	10.50	10.50	19.50	17.00	15.50	16.00	16.50	14.50	15.00	15.50	12.50	14.00	15.50

RAILROAD SCRAP

	Heavy Melting Steel	Scrap Rails	Rails for Rolling	Scrap Rails 3 ft. and under	Scrap Rails 2 ft. and under	Scrap Rails 18 in. and under
Pittsburgh, Wheeling, Steubenville, Sharon, Youngstown, Canton	$21.00	$22.00	$23.50	$24.00	$24.25	$24.50
Philadelphia, Wilmington, Sparrows Point	19.75	20.75	22.25	22.75	23.00	23.25
Cleveland, Cincinnati, Middletown, Ashland, Portsmouth	20.50	21.50	23.00	23.50	23.75	24.00
Chicago	19.75	20.75	22.25	22.75	23.00	23.25
Buffalo	20.25	21.25	22.75	23.25	23.50	23.75
Detroit	18.85	19.85	21.35	21.85	22.10	22.35
Kokomo	19.25	20.25	21.75	22.25	22.50	22.75
Duluth	19.00	20.00	21.50	22.00	22.25	22.50
Kansas City, Mo.	17.00	18.00	19.50	20.00	20.25	20.50
St. Louis	18.50	19.50	21.00	21.50	21.75	22.00
Birmingham	18.00	19.00	20.50	21.00	21.25	21.50
Los Angeles, San Francisco	18.00	19.00	20.50	21.00	21.25	21.50
Seattle	15.50	16.50	18.00	18.50	18.75	19.00

CAST IRON SCRAP OTHER THAN RAILROAD

(Shipping point prices in gross tons)

	Group A	Group B	Group C
No. 1 Cupola Cast	$18.00	$19.00	$20.00
No. 1 Machinery Cast, Drop Broken, 150 lbs. & Under	18.00	19.00	20.00
Clean Auto Cast	18.00	19.00	20.00
Stove Plate	17.00	18.00	19.00
Unstripped Motor Blocks	17.50	18.50	19.50
Heavy Breakable Cast	15.50	16.50	17.50
Charging Box Size Cast	17.00	18.00	19.00
Miscellaneous Malleable	20.00	21.00	22.00

Group A includes the states of Montana, Idaho, Wyoming, Nevada, Utah, Arizona and New Mexico. Group B includes the states of North Dakota, South Dakota, Nebraska, Colorado, Kansas, Oklahoma, Texas and Florida.

Group C includes states not named in groups A and B, plus Kansas City, Kans.-Mo.

*Open Hearth Grades refer to No. 1 heavy melting steel, No. 1 hydraulic compressed black sheet scrap, No. 2 heavy melting steel, dealers' No. 1 bundles, dealers' No. 2 bundles and No. 1 busheling. No. 1 chem. borings, 1 per cent oil, $1 under, No. 2, 1.5 per cent oil, $2 under heavy melting steel. No. 3 bundles, $2 under No. 1 heavy melting; cast steel, $2.50 over, No. 2 busheling, $2.50 under No. 1 heavy melting steel, auto springs, crankshafts, $1 over No. 1 heavy melting. Blast Furnace Grades prices refer to mixed borings and turnings, shoveling turnings, and cast iron borings.

A basing point includes the switching district of the city named. The Pittsburgh basing point includes the switching districts of Bessemer, Homestead, Duquesne, Munhall and McKeesport, Pa. Cincinnati basing point includes the switching district of Newport, Ky. St. Louis basing point includes the switching districts of Granite City, East St. Louis and Madison, Ill. San Francisco basing point includes the switching districts of South San Francisco, Niles and Oakland, Calif.

Inferior Grades: Maximum prices of inferior grades shall continue to bear the same differential below the corresponding listed grades as existed from Sept. 1, 1940, to Jan. 31, 1941. No premium allowed on grades considered superior, unless approved by OPA. Addition of special preparation charges prohibited. Purchase of electric furnace or foundry grades for open hearth or blast furnace use permitted only at no more than price for corresponding open hearth grade. Exceptions: Low phos. billet, bloom and forge crops and electric furnace bundles may exceed open hearth price, and electric furnace bundles may exceed blast furnace price, if material is delivered to the consumer direct from the original industrial producer.

Commissions: No commission is payable except by a consumer to a broker for services rendered, the commission not to exceed 50 cents per gross ton. No commission is payable unless: The broker guarantees the quality and delivery of an agreed tonnage the scrap is purchased at a price no higher than the maximum allowed; the broker sells the scrap to the consumer at the same price at which he purchased it; the broker does not split the commission with the seller of the scrap, with another broker or sub-broker, or with the consumer. Commissions must be shown as separate item on invoice.

Maximum Shipping Point Price: Where shipment to consumer is by rail, vessel or combination of both, scrap is at its shipping point when it has been placed f.o.b. railroad car or f.a.s. vessel. In such cases, maximum shipping point prices are: (1) For shipping points located within a basing point, the price listed in the above table for scrap at the basing point in which the shipping point is located, minus the lowest established switching charge for scrap within the basing point; and (2) for shipping points located outside a basing point, the price in the above table for scrap at the most favorable basing point, minus the lowest transportation charge by rail, water or combination thereof. When vessel movement is involved, dock charges shall be 50 cents at Memphis, $1 at Great Lakes ports, $1.25 at New England ports, 75 cents elsewhere. New England shipping point prices computed on most favorable basing point prices; maximum transportation charge on scrap from New England, $6.65 per ton.

Scrap shipped by motor vehicle is at its shipping point when loaded. For shipping points within basing points, maximum is price listed in table minus lowest switching charge. When outside basing point, maximum is price at most favorable basing point minus lowest established charge when hauled by common carrier. When hauled by seller charges are based on carload rate for rail shipment, minimum $1.00 per ton.

Maximum Delivered Prices: Determined by adding established transportation charges to shipping point price, not to exceed by more than $1 (plus freight rate increase March 18, 1942) the prices listed in the table for the nearest basing point. Certain exceptions specified in Revised Price Schedule No. 4 (Amendment 1) apply to St. Louis district consumers, to WPB allocations, to water shipments from Duluth or Superior, Wis., to shipments of billets, blooms and forge crops from Pittsburgh and to shipments of electric and foundry grades from Michigan; to shipments of turnings to ferroalloy producers and of borings to chemical users. Delivered prices of scrap shipped under WPB allocations may exceed prices at nearest basing point by more than $1, if most economical transportation is used.

Unprepared Scrap: Above prices are for prepared scrap. Maximum prices for unprepared scrap are $2.50 less (railroad grades $3.50 less; material from which Nos. 1, 2 and 3 bundles made is $4 less) than for the corresponding grades of prepared scrap, except for heavy breakable cast. In no case shall electric furnace and foundry grades be used as the "corresponding grades of prepared scrap." Graveyard autos not considered unprepared scrap.

Remote Scrap: Consists of all grades, except railroad scrap, in Florida, Montana, Idaho, Wyoming, Nevada, Arizona, New Mexico, Texas, Oklahoma, Oregon, Washington, Louisiana, Utah. Delivered price may exceed by not more than $5 the price at the basing point nearest consumer's plant, provided sworn details furnished OPA. Permission required to exceed by more than $5 the nearest basing point price. Colorado scrap is remote scrap for Colorado consumers only.

LOGEMANN
Presses for Sheet Scrap

THE NATION NEEDS YOUR SHEET SCRAP!

In mills, industrial plants and scrap yards, LOGEMANN SCRAP PRESSES are working day and night to prepare sheet scrap for the furnaces.

Sheet mills particularly recognize the value of the years of experience and the performance records which back up LOGEMANN designs and workmanship.

The line includes scrap presses *designed for mill service,* presses *designed for automobile plant conditions,* presses *designed for general plant applications.* Write for details.

The scrap press illustrated operates in one of the largest industrial plants. Compresses scrap from three directions to produce high-density mill size bundles. Built in various capacities.

LOGEMANN BROTHERS COMPANY
3126 W. Burleigh St., Milwaukee, Wisconsin

Sheets, Strip . . .

Sheet & Strip Prices, Page 380

Deliveries of black sheets, notably lighter gages, at the end of the quarter were heavier. Jobbers in some cases received more tonnage than expected, including some galvanized, although much of this volume was wanted earlier in the quarter; extended high rated orders have been substantially filled. Producers of cold-rolled are seeking orders, promising eight to ten weeks delivery in some instances. Consumer demand is maintained, but somewhat spotty. Sheet users with war contracts tend to buy more direct from mills.

Contracts are being closed on several thousand tons, various finishes, for the navy, including deliveries to Portsmouth and other New England yards and private shipbuilders and their subcontractors in the aggregate account for a substantial part of current demand.

Narrow cold strip mills, operating on directive quotas are at 75-80 per cent of capacity, with high carbon facilities engaged 100 per cent in most cases. Quotas originally directed continue on a monthly basis until changed. On this basis most producers are sold through first quarter on many finishes, accepting new volume subject to hold-ups in schedules or revisions in war product requirements. Tonnage tentatively taken for second quarter delivery will be geared to the Controlled Materials Plan.

Plates . . .

Plate Prices, Page 381

Orders for floor plate are barely sufficient for a full month's rolling, all tonnage practically under allocation within mill quotas, with shipbuilding taking the bulk of production. Under the current allocation-quota setup warehouses are placing firm orders for promised delivery with difficulty. Sheared material and wide, heavy sizes are as tight as ever, also larger flanged and dished work. Shipyard allocations are expected to be stepped up this quarter to the extent increased facilities are engaged, centered largely in subcontracting. To release 1500 railroad tank cars for the East, contracts are being placed for 300 semi-trailer petroleum tanks, 4000 gallons each, to be used in short hauls for oil in the Middle West.

Bars . . .

Bar Prices, Page 380

Deliveries on hot-rolled carbon bars, 1⅝-inch and under, are improving materially and against lower ratings; this is notably true with warehouse receipts.

With the higher ratings, shipments are also better on heavier hot rounds and flats, but improvement in cold-finished and alloys is slight, both holding tight. Against large highly rated orders and directives more cold-finished and alloy steel is promised for first quarter delivery.

While producers of hot carbon bars are able to get out more tonnage earlier, allocations to cold finishers regulate rerolled volume and some hot mills might readily meet heavier allotments to cold drawers. What slight improvement in cold-finished and alloys is noted is on small sizes; heavy cold-finished flats are scarce.

Demand for all finishes of bars is steady with consumption heavy; forged link chains require substantial tonnages and new war contracts include several taking heavier lots of flats for files, chisels and miscellaneous forged tools.

Pipe . . .

Pipe Prices, Page 381

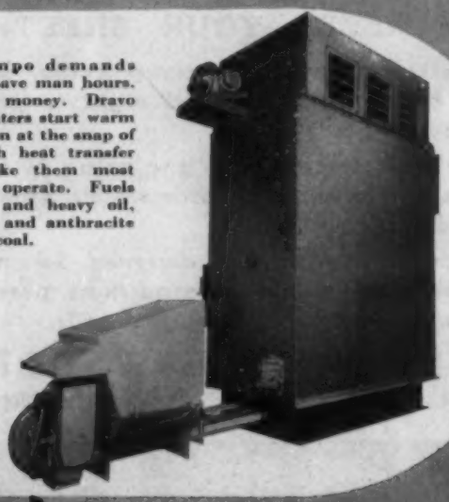
Demand for butt weld steel pipe has slackened, heating season requirements having eased while war demand for this grade is not heavy. Distributor stocks of galvanized are low and broken. Mills producing seamless tubing are heavily booked on direct orders and few have any substantial tonnage for warehouses and structural welded tubing has also tightened with deliveries lengthening.

Wire . . .

Wire Prices, Page 381

Wire mills have lopped off some low-rated unshipped tonnage from order books, starting the year on live volume with directives an increasing factor in scheduling production. Incoming orders are ahead of shipments, demand for aircraft wires mounting steadily, most of them alloys. Additional bullet core and chain link steel has been booked while pressure from rope mills and fabricators of balloon barrage cable is unabated.

The War Tempo demands methods that save man hours, materials and money. Dravo direct fired Heaters start warm air in circulation at the snap of a switch. High heat transfer efficiencies make them most economical to operate. Fuels are gas, light and heavy oil, coke oven gas, and anthracite or bituminous coal.



NOW! COAL-FIRED, SELF CONTAINED . . .

DRAVO DIRECT FIRED HEATERS

THIS coal-burning heater is a self-fired unit containing its own combustion chamber as well as the motors and fans to circulate warm air in the space to be heated. It is a "life saver" for those sections of the country where coal is the only available fuel. One or more heaters of this type can be arranged to provide working temperatures for any size or shape of industrial building. Such a system offers advantages of quick installation, lower cost than central steam plant, and flexibility in use to provide temporary heat or a permanent heating system.

Note—the heater shown above is hopper fed; bin fed models are also available; 9 sizes of self contained units, output capacities from 1,000,000 to 4,000,000 B.t.u. per hour output.

Write to us for catalog and specification sheets on types you wish to consider.

DRAVO CORPORATION
HEATER DEPARTMENT
Sales Offices in Principal Cities
DRAVO BUILDING PITTSBURGH, PA.

Rails, Cars . . .

Track Material Prices, Page 381

New car program for first half of 1943 apparently is fairly well established. Aside from 20,000 cars for the railroads under the order issued by the War Production Board about 37,000 cars will be built for the armed services, a total of 57,000 cars during first half, which represents approximately capacity operations for the industry.

It is entirely possible that second half will see substantial increases in cars for domestic use. The point will eventually be reached, and possibly in second half of 1943, where it will be more important to supply cars to domestic roads to keep freight moving than to supply cars to the Army and Navy.

Railroads in the first 11 months of 1942 placed in service 60,789 new freight cars and 668 locomotives, according to J. J. Pelley, president of the Association of American Railroads. Demand for steel and other materials for war purposes caused reduction in the quantity allocated for new railroad equipment, otherwise the number of new cars and locomotives would have been greater. Supply of some types of equipment, such as flat, gondola and hopper cars, at times has been barely sufficient to care for traffic demands. Additional equipment will be needed to enable railroads to meet transportation demand.

Capital expenditures in 1942 for equipment, roadway and structures and other improvements to property are estimated at $600,000,000, compared with $543,000,000 in preceding year.

Structural Shapes . . .

Structural Shape Prices, Page 381

Pressure of war demand for steel and limitation on building are reflected in new structural steel orders booked in November, totaling only 45,972 tons, lowest for any month since 1921, according to statistics of the American Institute of Steel Construction. This compares with 47,972 tons closed in October and 184,043 tons in November, 1941. Shipments, based on contracts previously booked, held up better, with November shipments of 127,052 tons, compared with 147,290 tons in October and 182,593 tons in November, 1941. Tonnage available for future fabrication at the end of November was 566,581 tons.

SHAPE CONTRACTS PLACED

5000 tons, bridge over Potomac river, Washington, for Pennsylvania railroad, to Bethlehem Steel Co., Bethlehem, Pa.

250 tons, open-hearth charging floor, for Lukens Steel Co., Coatesville, Pa., to Bethlehem Steel Co., Bethlehem, Pa.

100 tons or more, dry dock section, Morgan City, La., Bureau of Yards and Docks, to Chicago Bridge & Iron Co., Chicago; estimated cost, $4,490,000, including fee, contract No. 5463.

100 tons or more, two 200-ton gantry cranes, naval gun proving range, Arco, Idaho, Bureau of Yards and Docks, to Wellman Engineernig Co., Cleveland, $161,350; one 50-ton floating crane, navy yard, Pacific, to Anthony M. Meyerstein, Brooklyn, $178,650.

SHAPE CONTRACTS PENDING

100 tons, turbine erection shop for Westinghouse Electric & Mfg. Co., at Lester, Pa.

We can make it for you—now!

CHARLES C. DOYLE
President

I have a story to tell to the executives of big companies who want to get more production, or some special type of production, ***FAST.*** This is no pipe dream. This is what we have done, and are doing today, for some of the important prime contractors. We have made aircraft parts, gun sight parts, tank parts, landing gear parts and subassemblies, just to name a few.

The WPB people call our operation a Vertical Pool. We were about the first successful large scale operation of this kind, starting long before Pearl Harbor. The members of our group are thoroughly experienced and dependable. They include many small shops where the owners are skilled operators working on their own machines, and some large plants that have specialized facilities available from time to time.

And please get this straight—The J. E. Doyle Company is not a middleman performing simply a selling function. We have a skilled production and engineering staff which provides the technical and supervisory know-how that most of these small shops lack. We do the "paper work" which they are not set up to do themselves. We see that they are provided with the necessary tools, jigs and fixtures. We take the responsibility for results.

We are not price cutters, but our costs are amazingly low. The work is allocated to the various shops according to their ability to do the job ***satisfactorily, immediately*** and at a ***reasonable profit*** to themselves.

The essence of our service is ***SPEED.*** Give us the job today and we'll start turning it out tomorrow. I mean that literally. That's the one thing that everyone says is most important and yet I find it the hardest to get across to prime contractors. They just can't understand how we can move so fast.

That's why we are taking this means of telling our story. Some of you big executives will have the imagination to see in this Smaller Business Pool operation the answer to your production bottlenecks. We'll gladly furnish references.

Phone, wire or write today.

Charles C. Doyle

VICTORY POOL No. 1 OPERATING THROUGH

THE J. E. DOYLE COMPANY

INCORPORATED 1921

Engineers and Manufacturers of Infrared Ray Dryers

1224 WEST SIXTH STREET, CLEVELAND, OHIO

Pool Facilities Include: Machining, Metal Fabrication, Welding and Brazing, Plating, Aluminum and Bronze Castings, Precision Instruments, Electrical Heating Elements, Complete Assemblies

Nonferrous Metal Prices

Dec.	Copper Electro, del. Conn.	Copper Lake, del. Midwest	Copper Casting, refinerw	Straits Tin, New York Spot	Straits Tin, New York Futures	Lead N. Y.	Lead East St. L.	Zinc St. L.	Aluminum 99%	Antimony Amer. Spot, N.Y.	Nickel Cathodes
1-31	12.00	12.12½	11.75	52.00	52.00	6.50	6.35	8.25	15.00	14.50	35.00

F.o.b. mill base, cents per lb. except as specified. Copper and brass products based on 12.00c Conn. copper

Sheets

Yellow brass (high)	19.48
Copper, hot rolled	20.87
Lead, cut to jobbers	9.75
Zinc, l.c.l.	13.15

Tubes

High yellow brass	22.23
Seamless copper	21.37

Rods

High yellow brass	15.01
Copper, hot rolled	17.37

Anodes

Copper, untrimmed	18.12

Wire

Yellow brass (high)	19.73

OLD METALS

Dealers' Buying Prices
(In cents per pound, carlots)

Copper

No. 1 heavy	9.25-10.00
Light	7.25- 8.00

Brass

No. 1 composition	8.50- 9.00
Yellow brass castings	5.50- 6.00
Auto radiators	6.12½-6.62½
Red brass, borings & turnings	8.00- 8.50

Zinc

Old	4.75- 5.00
New clippings	6.00- 6.50

Aluminum

Clippings	9.75-10.25
Cast	8.75- 9.25
Pistons	8.50- 8.75
Sheet	8.75- 9.25

Lead

Heavy	4.75- 5.25
Mixed babbitt	5.35- 5.50
Electrotype shells	5.00- 5.50
Stereotype, Linotype	6.00- 6.75

Tin and Alloys

Block tin pipe	44.00-46.00
No. 1 pewter	32.00-36.00
Solder joints	7.75- 8.50

SECONDARY METALS

Brass ingot, 85-5-5-5, l.c.l.	12.50
Standard No. 12 aluminum	14.50

MAGNESIUM

(12 pound rod, 4 in. diam.)

99.8% ingot, carlots	22.50
100 lb. to carlots	24.50
Extruded sticks, ¼ to 2 lb.	
Carlots	32.00
100 lb. to carlots	34.00

● How come? Well, I'll tell ya—The Welding Boys down at Skunk Creek and the Die Fellers at Coon "Holler" got tired of beating each other's pants off, so in order to compromise, they decided to join hands and wallop the Axis instead. In other words, the tool and die game has nobly conceded the importance of welding within its ranks. This detracts not a particle from the prominence of the tool and die industry. By welding we mean the use of Eureka Tool Steel and Alloy electrodes on oil, air and water hardening dies and the now famous "Suttonizing" welding process that thoroughly reclaims high speed steel tools of most every sort.

Phone Fitzroy 3715 or write direct to

Welding Equipment & Supply Company

220 Leib Street, Detroit, Michigan

Reinforcing Bars . . .

Reinforcing Bar Prices, Page 381

Demand for new billet steel reinforcing bars has dropped practically to the vanishing point. From a low of 40,000 tons in November, demand dropped to only 20,000 tons booked during December, and probably not more than that will be booked during January.

Tonnages taken by rail steel mills are now larger than those by new billet mills. Production has been at a substantially higher rate than new business as a result of some backlog tonnage, but this has been wiped out and present backlogs are negligible.

Pig Iron . . .

Pig Iron Prices, Page 382

On the whole, pig iron distribution continues to work to the satisfaction of both producers and consumers. While subject to unforeseen demand in connection with war production it would appear consumption of iron has leveled off with the peak reached or passed. Melt by steelworks has been steady for months and little change is likely during first quarter and certainly the demand will not increase; open hearths are at capacity except for usual minor repairs and will remain so for an uncertain period.

Scrap . . .

Scrap Prices, Page 384

In most consuming areas scrap supply is sufficient for current needs, though winter conditions have slowed up flow considerably in some instances. In the St. Louis district some difficulty has been experienced in keeping supply up to requirements. Allocations have been issued to cover needs of some melters there but supply has not been sufficient to fill the allocation orders.

Some pressure on iron and steel scrap ceiling prices is apparent. Immediate supplies of cast, No. 1 machinery an exception, are heavier than demand in New England and Pennsylvania consumers are reluctant to pay $20 f.o.b.

for No. 1 cupola cast or $19.50 for motor blocks. Some tonnage is therefore going to that area slightly under the ceilings. Available No. 1 machinery is readily absorbed at ceilings. Evidence of price shading is also indicated by district steel mill bids for No. 1 heavy melting, $14.06 offered by two consumers instead of $15.05 at water differential areas; a third and largest consumer is paying $15.05, but holding to specifications strictly, including No. 1 bundles, low phos and No. 1 heavy melting. On longer hauls to outside points, notably on $4.85 freights or more, consumers press for shipping point prices which will at least balance ceilings.

Steel in Europe . . .

London—(*By Radio*)—Christmas observance was cut to a minimum in industrial plants in Great Britain, to maintain production at a high point. Steelmakers and fabricators are heavily booked through first quarter. Heavy grades of scrap are in strong demand but lighter classifications are relatively quiet.

Indium Prices Reduced

Indium Corp. of America, Utica, N. Y., and New York City, a leading producer of indium, announces reduction in price of commercial indium from $12.50 to $10 per Troy ounce and in electrolytic indium from $30 to $15 per Troy ounce, both reductions effective immediately. These changes will be reflected in prices of indium salts. Concurrently with the price changes purity of commercial grade will be increased from 98 per cent plus to 99 per cent or better.

Canada . . .

Toronto, Ont.—Orders for most lines of steel continue in heavy volume with war consumers more active in placing orders covering requirements two or three months into the future. Inquiries and orders from civilian and non-essential users, however, have dropped sharply. Canada now appears to be assured of sufficient supply to meet present and proposed war expansion programs, the minister of munitions and supply announced. Canadian iron and steel production is holding close to capacity.

Inquiries are increasing for plates and sheets and other steel materials in connection with the shipbuilding program, and it is estimated that demand on this account for the coming year will increase about 40 per cent over 1942.

Increased production of carbon and alloy bars recently has relieved some of the pressure on imports from the United States, but this country still draws heavily on the latter for urgently needed stocks. Fresh orders, however, continue to appear and mills are adding to backlogs for delivery throughout first half.

Interest in wire and wire products is beginning to lag and inquiries and sales are below the high record for 1942. While demand is off there is no indication of a surplus of these materials, but a serious shortage in eastern Canada, although western Canada is fairly well stocked.

FLEXPEDITE

Your Conversion—Assembly—Production with

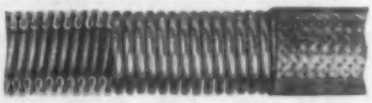
REX-WELD

Flexible Metal Hose

Rex-Weld Hose—Annular Corrugations

RW-80 Unbraided —— RW-81 Braided

Rex-Weld Hose—Helical Corrugations



RW-90 Unbraided —— RW-91 Braided

General Data

	STEEL	BRONZE
Sizes	To 4" I.D.	To 4" I.D.
Pressures	To 14,500 p.s.i.	To 14,500 p.s.i.
Temperatures	To 1000° F	To 450° F.
Lengths	To 50′	To 50′

Use Chart

	*STEEL	BRONZE
Saturated Steam		✓
Superheated Steam	✓	
Sulphur Bearing Oil	✓	
Oxygen		✓
Ammonia	✓	
Carbon Dioxide	✓	
Sulphur Bearing Grease	✓	
Critical Vibration		✓
Non-Sparking		✓

*Protective Coatings Can Be Applied for Corrosion Protection (To Conserve Critical Copper Bearing Alloys).

Couplings: REX-TITE Mechanical (Re-attachable) Couplings; Solder Couplings; Brazed and Welded Couplings and Flange Assemblies for Rex-Weld Flexible Metal Hose.

Ask for Engineering Recommendations

CHICAGO METAL HOSE CORPORATION

General Offices: MAYWOOD, ILLINOIS

Factories: Maywood and Elgin, Ill.

Floods Curtailing Steel Operations in Pittsburgh Area

As this department of STEEL's Yearbook is going to press floods are reported interrupting steelworks operations in the Pittsburgh and Wheeling districts. The extent at this time is not fully known, but they will affect the average of steelworks operations in those districts for the week.

Up to midweek—prior to the floods—Pittsburgh district steelworks were operating at a weekly average of 98 per cent, ½-point above the average for the prior week, as repaired equipment was relighted. Wheeling district had dropped 3 points to 82½ per cent, as open hearths were taken off for repairs.

On Wednesday two plants at McKeesport went down. The open-hearth shop of a large independent company close to the downtown area of Pittsburgh was largely out of production, as was the finishing mill facilities of the same company nearby. Blast furnaces in the same area also were to be banked by nightfall, it was expected. The blast furnace plant of another company also was threatened.

Several down-river mills were forced to curtail or entirely cease production Wednesday afternoon.

Production of other plants was being affected by flooded railroad lines and boat-loading and unloading facilities.

Cleveland—Curtailment by one interest reduced the rate 2 points to 92½.

Central eastern seaboard—Unchanged at 95 per cent, with scrap supply sufficient.

New England—With all open hearths back in service after repairs the district is producing at 100 per cent.

Birmingham, Ala.—Steady at 95 per cent with 23 open hearths active.

Detroit—Taking no account of the holiday steel production remained at 89 per cent.

Chicago — Declined ½-point to 102 per cent, condition of furnaces being the only limiting factor, as scrap supply is adequate.

Youngstown, O.—Continued at 97 per cent, with 77 open hearths and three bessemers active. One Republic Steel Corp. blast furnace resumed Dec. 25 after relining and another suspended the first of last week.

Cincinnati—Off 1 point to 88 per cent, one interest continuing at capacity.

St. Louis—Unchanged at 93 per cent, with all departments working through Jan. 1.

Buffalo — Although steelmaking touched 93 per cent at midweek it averaged 90½ per cent for the week.

DISTRICT STEEL RATES

Percentage of Ingot Capacity Engaged in Leading Districts

	Week ended Jan. 2	Change	Same week 1942	Same week 1941
†Pittsburgh	98	+0.5	96	95.5
Chicago	102	—0.5	101.5	99.5
Eastern Pa.	95	None	89	95
Youngstown	97	None	92	92
†Wheeling	82.5	—3	91	96
Cleveland	92.5	—2	94	84
Buffalo	90.5	None	81.5	93
Birmingham	95	None	95	100
New England	100	+4	100	85
Cincinnati	88	—1	91.5	87
St. Louis	93	None	76	87.5
Detroit	89	None	90	90
Average	99	None	*97.5	*92.5

*Computed on basis of steelmaking capacity
†At midweek, prior to floods. Subject to revision.

50,000-Ton Plate Increase

Plate requirements for war purposes continue to grow and WPB plans to increase plate production in January by another 50,000 tons. High point was in July when 1,124,000 tons was made. New plate capacity under the expansion plan will not be ready until April.

WIRE

Round + Flat + Square
Straightened and Cut
Shape Wire

+

HIGH CARBON SPRING
LOW CARBON BASIC AND BESSEMER
OIL TEMPERED
WELDING WIRE RODS AND COILS

+

Sizes ½" to No. 40 WM Gauge (.007)—All Finishes

+

Wire for Practically All Purposes
and Requirements
Also SCREEN WIRE CLOTH

+

Highest Quality and Service Guaranteed

+

Established 35 Years

FLAT COLD ROLLED
STRIP STEEL

The Seneca Wire & Mfg. Company
Fostoria, Ohio

Representatives and Warehouses in practically all principal cities

Britain Asks—
What Price Liberty?

(*Concluded from Page* 361)

stand against any measure tending to fixing and control of wages by government, which, he said, would continue to rely on the policy of collective bargaining. Apparently, wages are one of the very few factors in the country's economic life that government prefers not to control.

The picture that has been drawn tends to show that freedom of the individual has been severely curtailed, but the fact must be emphasized that all restrictions have been imposed with the consent of Parliament representing the will of the people.

Compare this with methods used by dictators of the Axis powers, who resort to the worst measures of compulsion against the will of the peoples they have conquered and, it may be believed, against the will of some of their own people.

On the one hand, *restrictions freely accepted* by the community to preserve the principle of Liberty—on the other hand, a return to the terrors of the Dark Ages and to the worst methods of slavery.

That is the issue that is being fought out in the various theaters of war and in the factories. The outcome of the struggle is beyond question, and the contrast between the spirit and results of efforts of workers on both sides respectively is a true indication of the eventual denouement.

Some Restrictions May Stand

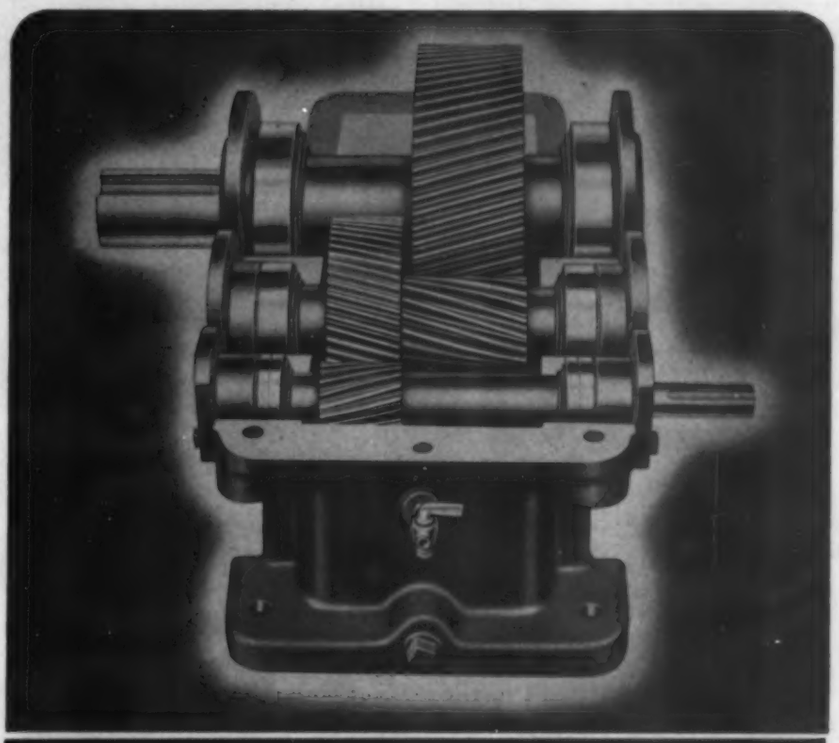
What of the future? As intimated at the beginning of this article there is every reason to believe some restriction of the freedom of private enterprise will remain after the war, even beyond the transitional period. Pointers in this direction can be found in the Atlantic Charter. The fourth principle provides for the access by all states to the trade and to the raw materials of the world. This entails control of distribution of raw materials and, no doubt, some measure of control in regard to international trade.

The fifth principle provides for collaboration between nations to secure improved labor standards, economic advancement and social security. Freedom from want is specified in the sixth principle. This implies the establishment of minimum standard wages and conditions of work. Thus a restricted form of freedom will be more evenly spread over the whole of mankind than was the case before this war.

In conclusion, it seems evident that Liberty for all must be purchased at the cost of the imposition by the governments in power of stricter controls and greater restrictions on the freedom of individuals and of private enterprise. If this means greater and more widespread happiness for mankind, and the avoidance of future wars, the price is well worth while; provided that all future governments shall be democratic in form; that demagogy shall not be substituted for other forms of autocracy; and that, subject to the necessary limitations, the widest possible scope shall be given to individual initiative and responsibility to counteract the depressing, and sometimes killing, effects of bureaucracy.

Institution of Mechanical Engineers, Storey's Gate, St. James Park, London, S. W. I, announces that it has elected Orville Wright, Dayton, O., an honorary member "in recognition of his distinguished contributions to mechanical science."

Institute of Metals, same address, announces that Prof. G. P. Thomson, D. Sc., F.R.S., will deliver the 1943 May lecture on "Electron Diffraction".



MONEY-SAVING HELICAL REDUCERS

★ It's a two-way saving . . . in manufacturing because of the simplicity of design by Horsburgh & Scott engineers and . . . in maintenance and freedom from breakdowns because of the rugged and precision construction of every part from the finest materials. Investigate these H. & S. Helical Reducers with their lower first cost and longer trouble-free life.

Send note on Company Letterhead for Speed Reducer Catalog 39

THE HORSBURGH & SCOTT CO.

GEARS AND SPEED REDUCERS

5112 HAMILTON AVENUE • CLEVELAND, OHIO, U. S. A.

Markets Under Federal Control Entire Year

(*Concluded from Page* 363)

rate of steel production calling for tonnages in excess of any previous period. In the fall a campaign was started, supported by lavish advertising announcements in magazines and newspapers, to bring out dormant material from households and industrial establishments. This resulted in an unexpected outpouring which solved the problem for fall and early winter. Much of this material was of low grade and light gage, requiring much preparation and, with shortage of labor, scrap yards found processing slow.

Faced by winter conditions the salvage departments of WPB organized other drives to bring out further supplies from industry and established a criterion for dormant material. This was non-use for three months and no probability of use for another equal period. This produced a better grade of material, including obsolete machinery and equipment and steel from abandoned bridges and structures. At the end of the year ample supply was at hand for current steelmaking and some reserves had been accumulated for future use. However, fears were felt that another squeeze would occur early this year.

Prices in the main were unchanged through the entire year. Office of Price Administration had imposed ceilings on practically the entire market in 1941 and these are still in effect. Slight adjustments were made from time to time to meet unfair conditions as they arose but the main structure was not altered. OPA established maximum prices on Lake Superior iron ore at the levels prevailing in 1941. Some sellers had charged less than published quotations in 1941 and were required by the order to continue these prices in 1942.

Pig iron was handled on a complete allocation basis, quotas being given suppliers each month after consumers had filed requests for tonnage. In general the plan worked with satisfaction to all interests and little criticism was met. Record tonnages were produced and essential needs were met closely.

Restrictions on building construction cut back demand for structural shapes and reinforcing bars but shipbuilding required a fairly large tonnage of light shapes. Fabricators sought to keep their shops operating by taking subcontracts for various products outside their regular lines, such as subassemblies for ships and tanks, and thus managed to replace much of their loss.

Many Records Fall

Records were broken continuously through the year. Scarcely a steel mill department failed to better its previous performance and marks deemed peaks one month were exceeded the next as management and labor vied to get out more tonnage than ever before. The world's record for pig iron production in a single month by a single blast furnace stack had stood unchallenged since 1931, but in January it was broken and four more times in 1942 new tops were recorded, the best mark, in October, being almost 5000 tons over the 1931 record. Iron ore tonnage moved from Lake Superior mines was more than 11,000,000 tons greater than the record tonnage in 1941. In pig iron and steel ingots, the record levels of 1941 were left far behind.

Production of steel, measured by ingot output, was above 94 per cent of rated capacity through the entire year and averaged better than 96 per cent. In October it reached a peak of 100.1 per cent of capacity.

Warehouses, the retail merchants of the steel industry, suffered a famine through much of the year and not until the closing months were they able to obtain supplies approaching the demand of their customers. Assortments were broken and stocks small most of the time.

WEARERS of the "Face-Fitt" eye protector will find it meets their every demand. It is practically "Fog-Free" because of all-around ventilation. It has wide, flared-out, comfortable facial contact surfaces. It is made in three sizes—the right fit for every face.

Buyers of the "Face-Fitt" goggle will be delighted with its ruggedness, durability and protective qualities. They will especially like the prompt delivery, because it is made from materials readily available.

Truly, this remarkable goggle is made for you, and you and you.

KIMBALL SAFETY PRODUCTS COMPANY

7314 WADE PARK AVENUE · CLEVELAND, OHIO

MEN of INDUSTRY

Joseph A. Horne, heretofore vice president in charge of production, Yale & Towne Mfg. Co., New York, has been elected chairman of the board, succeeding the late John Henry Towne. Associated with the company 51 years, Mr. Horne has been a vice president 26 years.

Calvert Carey, assistant to Mr. Horne, has been named vice president in charge of production. He has also been elected a director.

—o—

Henry T. Riddick, associated with Osborn Mfg. Co., Cleveland, 32 years, has been named sales service manager

HENRY T. RIDDICK

of the company's brush division. He will continue to serve as credit manager, which office he has held many years. In his new duties he replaces **L. J. Bechhold,** who recently resigned.

—o—

A. G. Dennison has joined the staff of Wolverine Tube Division of Calumet & Hecla Consolidated Copper Co., Detroit. A native of Maryland and a graduate of Washington and Lee University,

A. G. DENNISON

he will make his headquarters in Washington, and have charge of the company office there.

—o—

V. Gilmore Iden has resigned as secretary, American Institute of Steel Construction Inc., New York, to become industrial editor, Bureau of National Affairs, Washington. He has been secretary since 1933.

—o—

Herman W. Steinkraus, president and general manager, Bridgeport Brass Co., Bridgeport, Conn., has been named aide de camp with rank of a Colonel to Governor-elect Raymond E. Baldwin's military staff. A native of Cleveland, for a number of years he was sales manager of Osborn Mfg. Co. In 1924 he started his own metal and chemical business which he sold four years later to Bridgeport Brass Co., and at the same time was appointed general sales manager.

—o—

Dr. Robert E. Wilson, president, Pan

AMPCO CASE HISTORIES

270° degrees below zero!

(4 times as cold as the stratosphere)

yet AMPCO METAL'S strength was unimpaired

Colder than cold! 270° below zero Fahrenheit! Bronze parts in a machine made by a well-known pump and compressor manufacturer were subjected to this intense cold in valve applications — and the Ampco Metal stood up satisfactorily — its qualities unimpaired after months of service. Laboratory tests have shown that the tensile strength and elongation of Ampco Metal increases as the temperature drops — important under certain service and installation conditions.

When trouble is encountered due to metal wear, deformation and fatigue, try parts made of Ampco Metal. Twenty-eight years of "know how" lie behind the alloying of this amazing bronze. Literature will be sent you on request. Ask for "File 41—Engineering Data Sheets."

AMPCO METAL, INC.

DEPARTMENT 5-1 MILWAUKEE, WISCONSIN

AMPCO METAL

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THE METAL WITHOUT AN EQUAL

American Petroleum & Transport Co, will be presented with the Perkin medal at a joint meeting of the American section of the Society of Chemical Industry, American Institute of Chemical Engineers, American Chemical Society, Electrochemical Society and the Societe de Chimie Industrielle in New York, Jan 8. The medal will be awarded to Dr. Wilson in recognition of his research studies.

—o—

Dr. Edwin Howard Armstrong, professor of electrical engineering, Columbia University, has been awarded the Edison medal for 1942 by the American Institute of Electrical Engineers, "for distinguished contributions to the art of electric communication, notably the regenerative circuit, the superheterodyne, and frequency modulation". The medal will be presented to Dr. Armstrong Jan. 27, during the national technical meeting of the institute in New York.

—o—

E. W. Husemann has been appointed metallurgist, Copperweld Steel Co., Warren, O. Mr. Husemann was formerly associated with Republic Steel Corp. at Chicago.

E. W. HUSEMANN

F. M. Joy, manager of the Tennessee Coal, Iron & Railroad Co.'s land department, and vice president of the Tennessee Land Co., retired Dec. 31, under the United States Steel Corp. retirement plan. Succeeding Mr. Joy as manager of the land department is **John M. Glasgow,** present assistant manager.

—o—

Bennett S. Chapple Jr. has been appointed assistant manager of sales, New York district sales office, Carnegie-Illinois Steel Corp. Mr. Chapple, formerly assistant to the vice president, operations, in charge of emergency defense co-ordination, is succeeded by **Ross L. Leffler,** who, in addition to his duties as special representative, will co-ordinate emergency defense measures in the company and co-operate with public authorities and defense agencies.

—o—

Irving F. Pohlmeyer, West Coast sales and service engineer for Ohio Seamless Tube Co., Shelby, O., is now located at suite 200, 170 South Beverly drive, Beverly Hills, Calif.

—o—

John A. Ross has been appointed manager of Crucible Steel Co. of America's alloy sales department and will be located in New York. He has long been associated with the company's Pittsburgh-Crucible Sales Division.

—o—

R. C. Wietersen has been appointed director of purchases, Buda Co., Harvey, Ill. The past two years Mr. Wietersen was director of purchases for National Supply Co., Springfield, O., and for four years prior to that he was director of purchases of Hercules Motors, Canton, O.

—o—

A. J. McAllister, president, Fairfield Mfg. Co., Lafayette, Ind., has been elected president, Indiana Manufacturers Association.

How to Keep YOUR Electric Cranes & Hoists

EVERLASTINGLY ON THE JOB

THE MAINTENANCE MAN'S CREED—"An ounce of prevention is worth a pound of cure."—was never more significant than it is under today's grueling production schedules.

IN THE MANUAL illustrated here, for use with Shepard Niles' Cranes and Hoists, maintenance men will find the answer to many problems of crane and hoist care and operation. This manual has been planned expressly to do two things:

FIRST, to assist the war effort, by helping to prevent costly shutdowns, through timely suggestions on crane and hoist operation.

SECOND, to help the maintenance man make repairs on the spot, quickly and efficiently, through furnishing him with detailed information, amply illustrated and easily found, concerning the construction of Shepard Niles' Cranes and Hoists.

WRITE FOR YOUR COPY TODAY

YOU MAY NEED IT TOMORROW

● 104 pages—amply illustrated with sectional views and line drawings. Covers the complete line of Shepard Niles' Electric Cranes and Hoists. Sturdy, flexible cover. Special binding for easy opening. Convenient (7¼" x 10¾") size.

Shepard Niles

CRANE & HOIST CORPORATION

358 SCHUYLER AVENUE • MONTOUR FALLS, N. Y.

OBITUARIES . . .

George Henry Blakeley, 77, former vice president, Bethlehem Steel Co. and Bethlehem Steel Bridge Corp., died Dec. 25 in Newport, R. I. When Bethlehem Steel Co. acquired the McClintic-Marshall Co. in 1931, Mr. Blakeley who at the time was a vice president of Bethlehem, was made president of the subsidiary.

A graduate of Rutgers University, Mr. Blakeley was an expert in devising and developing improvements in manufacture and uses of structural steel, one of the most important being broad flange structural steel sections, introduced by Bethlehem in 1908. He participated in the erection of many important bridges, among them the Golden Gate bridge at San Francisco, Delaware River bridge at Philadelphia, and Peace bridge over the Niagara river at Buffalo.

Mr. Blakeley was a director of Bethlehem Steel Corp. and Bethlehem Shipbuilding Co. He was also a member of the American Society of Civil Engineers, American Society of Mechanical Engineers, American Iron and Steel Institute, Engineers' Club of New York, and other organizations and societies.

—o—

Harold K. Jackson, 47, sales manager for the northern district, Mid-West Forging & Mfg. Co., Chicago, died at his home in LaGrange, Ill., Dec. 11. He joined the Mid-West organization in 1935, and before that was associated with Jones & Laughlin Steel Corp.

—o—

George A. Brown, 67, office manager and technical adviser, Brown Steel Tank Co., Minneapolis, died in that city recently. He was formerly general manager of the company and was one of the founders of Brown Sheet Iron & Steel Co., St. Paul, later succeeded by the Stainless & Steel Products Co.

—o—

Robert G. White, 46, superintendent of coke ovens and blast furnaces, Otis works of Jones & Laughlin Steel Corp., Cleveland, died Dec. 29 in that city.

—o—

Harry F. Henninger, 61, foundry superintendent, Farmall works, International Harvester Co., Rock Island, Ill., died Dec. 8. Associated with the company 12 years, he was foundry superintendent the past four.

—o—

C. V. Lauer, 46, senior assistant superintendent of blast furnaces, Gary works, Carnegie-Illinois Steel Corp., and brother of **H. V. Lauer,** division superintendent of blast furnaces at the same plant, died in Gary, Ind., Dec. 28.

Close-ups of AGILE

ALLOYING *Interfusion* WELDING ELECTRODES

Our ad last month used the word "SENSATIONAL" for this newest AGILE welding electrode development. This is putting it mildly, as the new cutting edges given to old tools by Silver-Red and Silver-Green electrodes stand up under the most grueling jobs.

Cutting tools tipped with Silver-Red in actual tests have proved unusually successful. Chisels tipped with Silver-Green pierce steel plate with ease—yet still retain unmarred cutting tips.

These electrodes are unsurpassed in the building of new tools, punches, chisels, dies of all kinds, etc.

Write for informative literature today:

The above unretouched photo shows a Silver-Red tipped cutting tool in use

Note the perfect edge of the Silver-Green tipped chisel (Unretouched photo)

AGILE ACTARC

AMERICAN AGILE *Corporation*

5806 HOUGH AVE. · CLEVELAND, O.

Windows of Washington

(*Concluded from Page 233*)

to the effect producers of iron and steel products could use an A-10 rating to obtain office supplies and similar materials under the terms of Amendment No. 2 to Preference Rating Order P-68.

It was announced that much of the steel plates for the nation's merchant ships would come from the mills that in 1941 were turning out sheet steel for automobile bodies.

Order M-21-c was announced formalizing the allocation system on steel plates.

Announcement was made that war orders for steel must be produced in proper sequence of preference rating regardless of the product involved. Further restriction was ordered for the use of chrome steel.

It was announced that requirements for sheet steel for the manufacture of steel drums, up to that time met by allocation, would be obtained only on preference ratings, except for urgent military needs, and allocations were sharply curtailed.

Deliveries of iron and steel products were restricted to preference ratings of A-10. Segregation of tin plate and tin alloy scrap from other scrap for delivery to steel mills was ordered. Iron and steel conservation was ordered under General Conservation Order M-126.

Production of alloy iron and steel was ordered subject to monthly melting schedules to be issued by WPB.

To relieve a shortage of steel drums for export shipment on the east and west coasts, reserve allotments of steel sheets for this purpose were expanded to include both hot and cold-rolled sheets by Amendment No. 2 to General Preference Order M-45.

Steel for 90-millimeter armor-piercing and semiarmor-piercing shot was placed under complete allocation.

Mandatory segregation of alloy steel scrap to conserve scarce alloying materials and permit their re-use was ordered. Changes in steel conservation order M-126 were announced.

Heat-resistant steel alloys for American industry were scaled down to a wartime basis. Deliveries of iron and steel plates were restricted to rating of A-1-k or higher with certain exceptions. This action was taken in an amendment to M-21-c.

Ratings of AA-3 were applied for maintenance, operating or repair supplies for iron and steel mills in an amendment to Order P-68.

A check was made into the operations of manufacturing users of iron and steel who were subject to General Conservation Order M-126, and was carried out by the Compliance Branch. The conservation order prohibited the use of iron and steel in the production of some 400 articles of common civilian use.

It was announced that steel and iron products as used in Order M-21 did not include used or salvaged materials, with the issuance of Interpretation No. 1 to that order. The director general for operations announced the revocation of Order M-21-f which provided for allocation of armor-piercing and semiarmor-piercing shot steel.

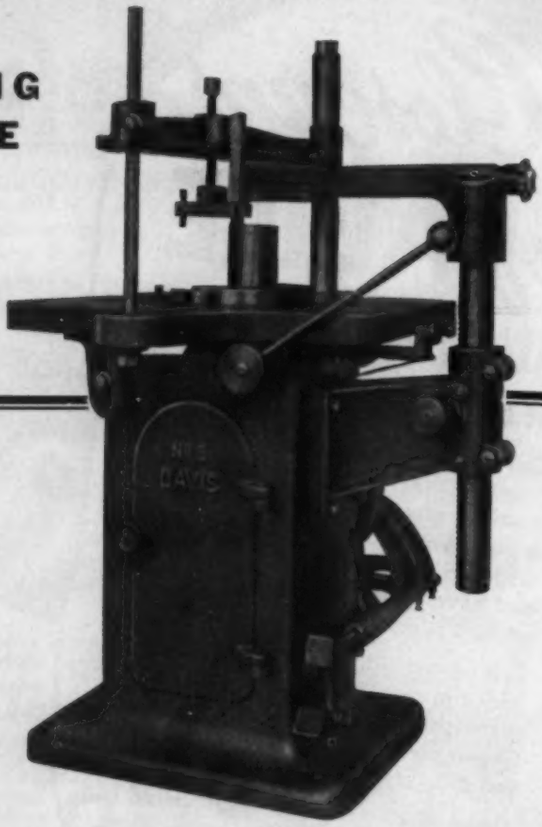
National emergency specifications for steel products were established.

Producers of iron and steel ferroalloys and blast furnace coke were permitted to use higher ratings during the fourth quarter of last year for repair and maintenance supplies.

New Type

DAVIS KEYSEATERS

with
TILTING TABLE



● Taper keyways may be cut by inclining table in either direction from horizontal. Scale indicates exact taper per foot. Cutter operates in vertical position, with resistance arm adjusted to different cutters. Table-type feed with graduated collar on feed shaft to indicate depth of cut.

DAVIS KEYSEATER CO.
397 EXCHANGE ST. ROCHESTER, N. Y.

Carton Protects Reamers, Facilitates Shipping

A new carton for cemented carbide tipped reamers first of its type designed for packaging cutting tools, is announced by Wendt-Sonis Co., Hannibal, Mo. Its use, according to the manufacturer, saves packing time and labor, in addition to eliminating damage in handling. Various size die-cut fillers compensate for the differences in length and diameter of the reamers.

Mirrors of Motordom

(*Concluded from Page 243*)

through the Automotive Parts and Equipment Manufacturers Association, also were enlisted.

From this great array of talent were set up committees to function on all the different phases of war production, facilitating the exchange of information between companies so that the experience of one might become immediately available to another faced with a similar production task, thereby immeasurably speeding the entire production effort.

These committees, groups of production experts, are no debating societies as are so many committees. Though their members might have been competitors a year ago, they are now operational teams, set up to get work done quickly and efficiently. One is a team of production managers, engineers and master mechanics whose mutual problem now is the manufacture of tanks and armored combat vehicles. Another handles artillery; another, shells and ammunition; another, military vehicles; and two others, aircraft engines and parts and airplanes and parts.

Simplicity rules the operations of these productive teams. They meet about once a month, usually in the plant of a member. No secrets are withheld. The committeemen explore to their hearts' content, ask questions, inspect processes, study drawings and examine blueprints. They learn the facts, and after a day of exploration, assemble once more to compare notes.

The American Way

"Thus," relates an official ACWP report of the year's activities, "without fuss or fanfare and with a minimum of time-wasting paperwork, these product divisions of the Council foster the voluntary co-operation of proficient competitors. It is the American way, at its efficient best—a simple application to mass production of the effective teamwork with which American fighters are combating the Axis slave-nations' regimented mass destruction."

Certainly the effectiveness of the method in facilitating war production cannot be denied. So impressed were the nation's leading aircraft builders that they hastily organized similar war production councils, one on the West Coast and one in the East. The interesting question these councils raise is simply this: What of their postwar status? It is easy enough to postulate that, following the suspension of hostilities, all this co-operative work will be dropped, the committee disbanded and everything returned to the status quo. But will the experience now being gained from this war-inspired co-operative industrial movement be so easily laid away on the shelf? Might if not, in truth, forecast the pattern of a new postwar economy? Might it not point the way to a new era of industrial achievement, in which the best technical talent a great industry can assemble will work in co-operation to formulate the most efficient manufacturing methods?

This viewpoint admittedly does not jibe with the American system economy we have known since the onset of the industrial revolution of the nineteenth century. But it is interesting to place such a concept alongside the outline of a new "managerial" economy such as described in *The Managerial Revolution* by James Burnham. The similarity seems more than just happenstance.

What of the postwar automobile? Much has been written of the radical innovations in materials and designs which supposedly are just around the corner in motordom. The reader is hereby urged to forget them all. The postwar car will be virtually a duplicate of the last of the 1942 models, with minor refinements and embellishments. Principal tools, dies and fixtures used for the last passenger car models are being retained and will be dispensed with only as a last

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resort and in the event of the war dragging on for many more years.

Meanwhile there has been no time for any of the leading automobile producers to make any concrete plans for what they will build when the peace comes. Obviously there is some thinking going on behind the scenes, but the men who take the artists' drawings and translate them into steel and glass and rubber have had no time whatever to devote to postwar automobiles. Even assuming the victory should be won this year, it would take six months to get plants in shape to return to car production, and a mad race would ensue to see which company would be first (government controls might logically prevent this, however).

So the radical 1000-pound car, with the 100-pound aluminum engine, the plastic body and all the other innovations now being discussed so enthusiastically will have to wait. It is true that design change is being speeded up drastically by the accelerating effect of war on engineering development, but these new materials must go through the proving grounds, the test laboratories, and grueling road tests before they will ever be offered to the car-buying public.

Steel will continue to be the basic material in automobile bodies and chassis for several years to come. It provides the stiffness, the ruggedness, the stability impossible to duplicate in other metals or in nonmetallics. On the immediate horizon are other changes of more moment than any shift in the basic material going into automobiles. They include the full automatic transmission with fluid coupling between engine and power train; power braking and power steering; far-reaching improvements in heating and air conditioning of car interiors; permanent and fully-sealed engine cooling systems; changes in wheel suspension systems including the possibility of the airplane-type oleo; and maybe even a whirl at a hydraulic turbine drive on each wheel.

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AFA Plans Million-Dollar Foundation

A greatly expanded program for research and collateral projects of the American Foundrymen's Association is seen in announcement of the establishment of a foundation which will seek an initial fund of $1,000,000. A resolution by A.F.A. directors last July authorized such a move, to provide a more efficient plan than the old system of individual solicitations for each special project. Duncan P. Forbes, president, Gunite Foundries Corp., and president of the association, made the announcement.

Fund income is estimated at $25,000 to $30,000 and will be allocated annually to cover five-year periods to assure that continuing projects will be supported without interruption. A feature now being developed is a system of matching grants through co-operation with related interests.

The foundation board of trustees, defined by the A.F.A. board of directors, consists of the last seven living presidents of A.F.A. with the most recently retired president serving as chairman. The present board includes Herbert S. Simpson, chairman of the board, National Engineering Co., Chicago, as chairman; L. N. Shannon, vice president, Stockham Pipe Fittings Co., Birmingham, Ala.; Henry S. Washburn, president, Plainville Casting Co., Plainville, Conn.; Marshall Post, vice president, Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.; H. Bornstein, director of laboratories, Deere & Co., Moline, Ill.; James L. Wick, Jr., president, Falcon Bronze Co., Youngstown, Ohio; and Dan Avey, Avey Products Co., Tulsa, Okla.

Wing Tips

(*Concluded from Page 252*)

between types in ten years of effort. Certainly, in view of foregoing categories, there is no all-purpose plane, no cureall for winning a war in the air. Furthermore, as the detailed OWI report on airplanes pointed out, no military aircraft are perfect. They must be kept fluid in the matter of design, with the measure of their excellence the score of their showing against the enemy, and in different theaters of action.

The Navy went into the war with considerable quantities of aircraft not of the latest type, says the OWI, and unquestionably suffered losses which might have been avoided had the newest equipment been available. After one year of operation, this difficulty has been corrected and Navy planes are now held to be superior in all types to those of other navies. This fact will be further emphasized as the Navy begins to take deliveries on a three-billion dollar order for aircraft placed through a supplemental appropriations bill late last year.

Army planes have suffered in the Pacific because of enforced retirement to inadequate bases. In the European theater, the newest types of fighter planes—the Republic P-47 and Lockheed P-38 have not had the chance to be fully tested in combat, but they look promising. This sounds strange when measured up against the fact that hundreds of both types have been produced, and already the P-38 is evolving into an entirely new model.

P-39 and P-40 Unmatched

The Bell P-39 and the Curtiss P-40 fighters are now recognized as medium altitude and ground-strafing equipment, and in point of firepower, defensive armor and general ruggedness are matched by no other aircraft of their types. The P-39's 37-millimeter cannon is the heaviest ordnance carried by any fighter in the world. To indict these planes as unsuited for performance at 40,000 feet is unfair, since they were not designed for such operations.

In the field of multi-engine bombers, the U. S. stands unchallenged, and this year will see further strides in this direction. To bring the war to a successful conclusion, bombers with longer range, greater bomb loads, better defensive armor and firepower are held to be essential. They are coming.

So effective have U. S. medium bombers proved that they have been used successfully as both torpedo planes and multi-place fighters and escorts. The problem of greater range can be met by sacrificing part of the bomb load for interior gasoline tanks which can be jet-

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Basic Designs Plus Refinements

Designs for basic U. S. military plane types were drawn up perhaps five years ago, which indicates the necessary lag between designer and production line. Now in the test stages are a score of entirely new types, which Maj. Nathaniel F. Silsbee said in a recent address would "make the angels gasp." Six new types conceived by the Wright Field design staff were shown in STEEL for March 16, p. 50. While they were revolutionary in many aspects, the story is that these designs were released for publication because they were a few that had been *rejected* by the Army Air Forces!

Basic designs are of course in a continual stage of flux. While Chrysler plants were tooling to produce the Martin B-26 medium bomber, design changes were being received at a rate of 500 a week. Ford has encountered some 4000 design changes since starting work on the Consolidated B-24 four-motor bomber, now rolling in limited numbers from Willow Run assembly lines.

Future for Steel in Aircraft

The combat and transport plane continues to be essentially an aluminum alloy structure, and there are increasing doubts steel will make any serious headway in replacing aluminum for aircraft fuselages. In the first place, aluminum capacity has been pushed to such a tremendous level—around 1,000,000 *tons* a year or seven times the prewar level—that the matter of supply is becoming less critical. Secondly, fabricating methods are trending in the direction of welding instead of riveting, removing one of the chief objections to aluminum assemblies.

Thirdly, steel is needed more vitally in shops and ordnance than in airplanes. However, it might be added that aircraft will account for approximately 12 per cent of the production of electric furnace steel for 1942—12,500,000 tons—principally in the form of engine components, engine mounts, landing gear elements and propellers. Particularly in the propeller field is steel coming to the front, and it may well replace the forged aluminum design altogether if sufficient fabricating capacity can be organized.

Both forged and cast alloy steel crankcase sections now are in use in several models of radial engines, while alloy steel cylinder barrels are standard in all types of aircraft engines, most of them forged, though a few are now being centrifugally cast.

Low-alloy high-tensile steel has been applied successfully, along with plywood, in the North American AT-6 training plane. Steel is used in rudder, elevators, wings, wing tips, ailerons, fairing and cowling. Sheets vary in thickness down to 0.010-inch and the overall increase in gross weight of the plane was only 3 per cent. More recently Vultee research engineers have introduced a composite steel panel involving an outer flat sheet spot welded to an expanded steel mesh, both plain carbon steel. It appears to have interesting possibilities for fuselage panels and results in no appreciable increase in weight. First application was in a training plane.

Assembly Methods Modernized

A word about the trend in airplane manufacturing methods may be in order. As orders for planes began to come through in lots of 1000 instead of 13, manufacturers began intensive study of the most efficient assembly methods. A logical move was toward conveyor systems, first to supply parts to workmen at assembly jigs, then to move subassemblies to final assembly points, then, in some cases to move final assembly lines. It has not proved so easy to adapt large bombers to the moving assembly line, although Ford is trying it at Willow Run. Boeing engineers reject this system, preferring what they call a "production density" system of breakdown jigs, from which parts are moved to sets of three principal subassembly jigs and finally to

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an assembly floor. The system has pushed Boeing output 70 per cent ahead of schedule, it is claimed.

Forming of aluminum has been shifting gradually from drop hammers to hydraulic and mechanical presses and stretchers, although there are still plenty of hammers in use throughout the airplane plants. Some of the larger presses are equipped with rotary or sliding tables on which stock can be spotted over the dies which then index under the press ram while an adjoining series of dies is being stocked. Dies of inexpensive Kirksite, or a combination of lead and zinc, or a lower metal die and an upper rubber blanket as in the Guerin process, are commonly preferred to the more expensive alloy iron dies.

Automatic multiple punches, hydraulically powered, have been designed to replace the slower drilling and reaming process. One Boeing machine of this type, called the Octopus, turns out 45 times as many circumferential stiffeners as were made by a former method.

Pronounced increase in aluminum welding has developed in the past year, thanks in part to the incidence of refrigerated welding electrodes on spot welding machines which greatly minimize "pickup" of aluminum in welding and reduce the frequency of tip dressing.

Fastening of drilled aluminum sheets preparatory to riveting to fuselage or wing frame-work is one of the tedious aspects of airplane building. Special types of spring pins are used, but one innovation of the past year has been the adaptation of aluminum eyelets in this work. The eyelets, formed from aluminum tubing, are not removed prior to riveting, being forged right into the joint in the driving of the rivet.

Training Unskilled Operators

Thousands of new workmen and workwomen (some plants now ranging as high as 80 per cent women) in aircraft work have posed the problem of how to train these unskilled operators in reading and understanding conventional types of blueprints and drawings. A partial solution has been the use of perspective drawings, or production illustrations.

These simplified perspective drawings, stripped of dimensional markings and other hieroglyphics of engineering draftsmen, represent a new technique which has been of amazing assistance.

Operation of aircraft in Arctic regions and in the frigid stratosphere has compelled the development of suitable test methods to simulate temperatures and pressures encountered in this service. Several manufacturers have installed cold-test rooms and stratochambers to facilitate the observation of materials, lubricants and parts in subzero atmospheres.

A Look to the Future

A glance into the postwar future of aviation in this country may not be amiss in conclusion. Though the battle rages, and the demand for combat and training aircraft is unrelenting, still the peace must come eventually. What of our four-billion dollar industry (and maybe seven billion this year) when that day comes?

Certainly it must be recognized that no government, however wholeheartedly it may be committed to any economy of abundance, or prosperity insurance from the public purse, can maintain an industry of this size "on the house," so to speak. As in the last war, the airplane builders will see their market collapsing about them when victory dawns; perhaps not as rapidly as was the case in the last great war, but quickly enough to cause serious concern.

There are several alternatives open to keeping these vast airplane building plants at least partially alive. One is the possibility offered by the automobile market. Starved for new cars for several years and with war bonds to spend, the public might quickly turn to an automobile designed along aerodynamic lines,

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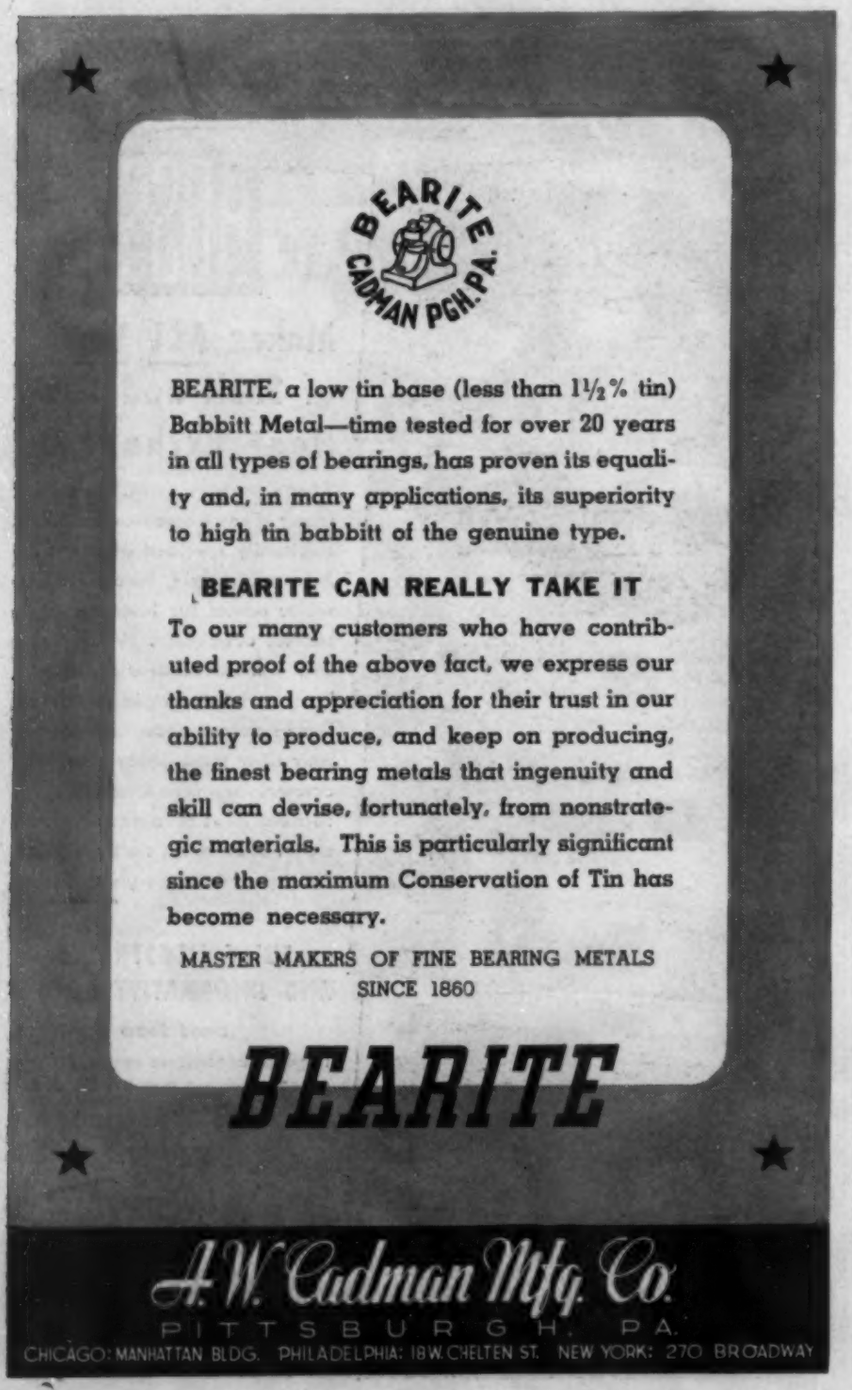
not particularly because it would be any better than conventional automobile designs, if indeed as good, but principally because of the novelty of owning a Martin Stratosphere Eight, or a Douglas Devastator Four, or a Boeing Blitzmobile. It is understood authoritatively that several aviation companies now have such motor car designs on the shelf as postwar aces in the hole. The tough problem here is how to retail them, with no dealer organization.

Then there is the fertile postwar market for household equipment to consider —refrigerators, stoves, electric cleaners, furniture, even prefabricated housing. There should be little trouble on the score of manufacturing talent, floor space or equivalent; again the stumbling block is marketing.

If the shoemaker is determined to stick to his last, then he must narrow his vision to commercial transport aircraft, and perhaps a dribble of private plane purchasing for sportsmen, top executives and idle rich (though existence of the latter is by no means a certainty). However intriguing the helicopter, the autogyro or the several types of foolproof light planes now on the horizon may be, it will take at least another generation before the U. S. goes into the air for mass travel. It will take no four-billion dollar industry to satisfy these needs for many years to come.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Randall and Hoyt Testify in "Hiring Hall" Labor Case

Clarence B. Randall, vice president, Inland Steel Co., declared before the War Labor Board last week that a mediation panel's recommendations on the dispute between Inland and the National Maritime Union take from private enterprise the privilege of hiring and promoting and place it squarely in the hands of union agents.

Randall appeared in the board's open hearing in the case of the Interstate Steamship Co., which with Inland, Bethlehem Transportation Corp., and International Harvester Co. is affected by the panel's recommendations.

Randall said the panel in its recommendations "has come out in favor of the union hiring hall system as a method employing unlicensed personnel for bulk freighters operated by Inland on the Great Lakes."

"With adroit language the panel glosses over the true meaning of its order," he stated, "but it is the hiring hall just the same . . . The very essence of private management is the right to hire and the right to promote," and added that "the panel decision takes both those rights from management and gives them to the union."

At the same hearing Elton Hoyt, Pickands, Mather & Co., Cleveland, speaking for "the 92 per cent of the industry not involved in the case," said no change should be made at this critical time in the methods which have been so successful over a long period. George Kirstein, executive secretary of WLB, previously had sent telegrams to shipping firms not directly concerned, inviting them to comment to aid the board in making a decision.

Mr. Hoyt said: "It is not our desire in any way to argue the specific issues as between the unions and the four companies who have today presented ably and thoroughly their views on these issues, but to stand squarely on only one fundamental proposition: Is it wise and is it desirable at this critical time to endanger the ability of the lake fleet to do its part in winning the war?"

(A more extensive report of the hearing will be presented in STEEL's issue of Jan. 11).

Machine Tool Builders Redouble Efforts

(*Concluded from Page 225*)

boosted production at least $300,000,000 over what it otherwise would have been. In view of scarcity of structural materials and labor, the fact that this building program now stands over 80 per cent complete, represents a really impressive achievement.

About the middle of the year George Brainard, at that time Director, Tools Division, War Production Board, called upon an Industry Advisory Committee appointed by him from among the machine tool builders, to assist him in making a complete survey of existing and future machine tool requirements. At the time this committee was organized, machines were being produced at the rate of nearly $127,000,000 a month, representing an annual output of $1,650,000,000—a large part of this being under-written by pool orders. Astronomical though these figures may appear to the layman, they were far enough short of the goal to cause considerable worrying among the officials whose business it is to keep their fingers on the pulse of the war production program.

Attack on Backlogs

When the committee came to consider all phases of the situation, it became evident that the most disconcerting thing was the tremendous backlog of orders hanging over the industry. This backlog, amounting to over $1,000,000,000, represented about eight months' production. Too great a proportion of it was made up of orders for critical machines, the need for which was and still is immediate and the lack of which is retarding vital parts of the army, navy and air corps programs. Lieut. General William Knudsen already had become aware of this during his extensive personal visitations to war plants. His urgent plea was: "Concentrate on these backlogs. Clear them up in six months instead of eight months!"

The result of General Knudsen's plea plus the conclusions of the Industry Advisory Committee has been that strong measures now are being taken to clear up the backlog. Analysis of it proves that it is very unevenly divided. While some companies are now able to make deliveries — especially on the more simple standard machines—in as little as two or three weeks, others are booked up for over a year ahead.

In view of this situation, the War Production Board, within the last month, has directed manufacturers burdened with excessive backlogs, either to hasten delivery through subcontracting or other

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expedients—or to surrender some of these orders to other companies who already have cleared their decks to the point where they can take care of this business promptly.

This drastic attack on the backlog has led to rumors to the effect that the machine tool industry has caught up with requirements and that it is looking for other work to do. Actually, the pressure on this industry for deliveries is greater than ever before—this at a time when the labor and materials situation is more difficult than ever before. Not until the last tool for the war program is delivered will the pressure be reduced, and not until then will the industry begin to consider other lines of production.

If and when that time ever comes, the government will have plenty of armament work for the industry to tackle, but for many months to come machine tool builders are going to be entirely too busy with machine tool building to be able to devote time and thought to conversion of their industry. Thousands of old and worn machines also must be replaced in war production plants before conversion is considered.

During 1942, and especially during the latter half of the year, the machine tool industry has been faced with realities having to do with materials shortages and with the draft, beyond anything which previously had been foreseen. Nickel long since has become a thing of the past in machine tool castings and drastic changes have had to be made in steel specifications. Earlier in the year great hopes were pinned on the National Emergency steels, but as the alloy shortages became far more critical than were expected, there has been a general trend among machine tool builders to reserve the scarce alloy steels for those machine elements which definitely demand alloys—carbon steels being substituted for all others. Adoption of improved methods of heat treating have done much to make this a practical wartime expedient.

Of other shortages, that of copper has been the most serious as far as the machine tool builders are concerned. With the able help of engineers of the electrical industry, this crisis has been met by careful review of motor and control apparatus, to make sure that this is not over-specified in relation to the end use to which the tools are to be put. As a result, considerable "overpowering" of machine tools has been brought to light and corrected, with the result that lighter motors and controls and less massive wiring has successfully been adopted in hundreds of cases. As a result thousands of pounds of copper have been saved for critical uses in other products.

Employment of Women

On the manpower front, it became evident early in the summer of 1942 that the machine tool industry could not hope for any blanket deferments of younger men who could be replaced within a reasonable time by others who by reason of age or other considerations were not basically in the 1-A draft category. The more forward looking companies saw in extensive employment of women the only sweeping answer to this situation. To make this possible they procured the services of capable women overseers — generally termed "Deans of Women"—built the necessary special restroom facilities and set about the recruiting and training of women to take the place of men on all except the heaviest and most highly skilled shop operations.

Results have been almost sensationally successful and more conservative companies which at first were slow to fall in line in the employment of women shop workers, now are doing so rapidly. In shops employing 2500 people it now

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is not at all uncommon to find that from 300 to 500 are women—with the proportion increasing rapidly.

This expedient — together with the "half-shift" plan whereby daytime white collar male workers—in teams of two—take over second shift jobs on the basis of four hours each day for each man of the two men crews—is serving to relieve but not cure the shortage of help. Until the war ends, this is going to continue to be one of the major problems of the machine tool industry.

What the industry faces in 1943 is well expressed in a recent statement by George H. Johnson: "We must continue to drive ahead—not just on the basis of maintaining our present production rate, but on the basis of increasing our production rate until we have built and shipped all machines now on order.

"These machines represent the additional production facilities required to give our national war production program the cushion of safety and the flexibility which it must have in order to meet whatever circumstances may arise in the course of the changing pictures on our many farflung war fronts."

Unprecedented Year Experienced by Tool Engineers

LIKE the machine tool industry to which it is so closely related that the line of demarkation often is difficult to draw, tool engineering and toolmaking experienced in 1942 a year of unprecedented responsibilities. Upon not one branch of American industry—not even the machine tool industry—has any more depended and does any more depend in the way of getting out the implements of war, than this formerly obscure group of specialists which rightfully has become known within recent years as tool engineers.

When the war began, the nucleus of this now very large group of engineers and skilled artisans consisted of a few thousand men, thinly scattered throughout industry, and generally referred to as toolmakers. Generally they were men of mature experience who as mechanics were able to turn their hands to almost any of the finer types of machine shop work and who as engineers had to exercise a rare mixture of inventive ability and common sense in the creation of special tools, jigs and fixtures upon which the American system of mass production—now linked almost in toto to war work—rests as a basic foundation.

How this relatively small group managed to spread its knowledge and skill throughout a vast influx of new workers —including great numbers of women— is one of the major industrial miracles of 1942. To make it possible, many traditions of the tool engineering profession had to be cast aside. Among these traditions was a certain "cagey" attitude which in the past made it difficult for outsiders to break into this field of activity.

When that went by the board, quick training in limited skills became possible through the breaking down of toolmaking jobs into basic components. The governmental educational activity called "Training Within Industry" was influential in bringing about this result, as also was the Emergency Training Committee of the American Society of Tool Engineers.

Quick rewards have come to old-line tool engineers through their co-operation in this work, for the reason that an essential part of the plan consists in "upgrading" of these trained men to executive and managerial positions over the tremendously expanded tool designing and toolmaking departments. These have sprung up both in older industries con-

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verted to war work and in new plants which during the year have been rushed to completion under the sponsorship of the Ordnance Department, the Air Corps and various Navy bureaus.

One of the interesting and extremely important results of this breaking down of toolmaking jobs into many single components, is the easing of the toolmaking equipment situation by the use of simple standard machine tools. As a result, it now is common experience to find a jig borer being supplemented by a battery of low priced drill presses operated by girls. The jig borer is used as the "laying out" machine and in some cases as the "final finishing" machine, but the yeoman service of metal removal is done by the drill presses.

By the same token, turret lathes now are being used extensively as "tool room lathes" because of the big runs involved in many tools used on war work. This makes it possible to use special tools in conjunction with set stops on cross and turret feeds—so that little or no measuring of individual parts is involved. Thus the work can be run off by operators of limited skill. In line with this same reasoning, jigs and fixtures are now being employed in the mass production of tools, frequently in conjunction with heavy duty milling machines and big surface grinders—machines which ordinarily have not been associated with tool rooms.

Aside from the shortage of skilled workers, the most serious situation which the tool engineering profession has met—and licked—during 1942, has been material shortages. While shortages of alloy steels admittedly have been a serious threat to the machine tool industry, substitute materials have at least proved a partial solution there. When it comes to cutting tools, however, substitute materials are of very limited help. Aside from extensive use of manganese steels in place of the still scarcer tungsten alloys, the problem with tool engineers has been "how to make a little of the real thing go far."

Great ingenuity, which undoubtedly will have continuing effect on postwar tool engineering, has been shown in the direction of making small bits of high speed steel and cemented carbide cutting materials do the work of what previously had been big chunks of these vital cutting materials. This technique is being applied to large forming tools and drawing dies, as well as to turning tools, reamers, milling cutters, etc.

Emphasis on Tool Conservation

Economy in tool material has not stopped with the actual cutting elements, but lately has been extended to the material of which the heavy shanks and bodies of the tools are made. Thus, in place of the customary steel shanks and bodies, we now find many successful tools with close grained, high tensile cast iron shanks and bodies to which high speed steel or cemented carbide cutting bits are brazed. A significant example of this is a complete line of milling cutters having bodies of Meehanite.

As far as actual operation of production tools is concerned, ever increasing emphasis throughout the year 1942 has been placed on tool conservation. This has had three phases: First, emphasis on careful handling of tools to avoid breaking and undue wear; second, greater emphasis than ever before on the salvage and rehabilitation of tools unavoidably worn or broken; and third, segregation and prompt return to tool manufacturers of all tools beyond rehabilitation, so that the steel can be reclaimed and made into new tools. This third phase has extended even to the smelting of sludge from tool grinding operations—where it exists in sufficient quantities to afford such treatment.

While it may be true that the end of the so-called tooling-up period in our war effort may be in sight in certain instances, this period in its over-all

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sense will not be over until the last shot is fired and the last bomb is dropped. Tool replacements and improvements in tooling will constantly be needed, and changing requirements brought about by sudden changes in the character of the war will introduce huge new tooling programs. Recent swing in emphasis from tanks to aircraft is a good example of this.

Then—when peace finally does come—it will be up to the American tool engineering profession to play a major role in the retooling of America for peace and in the rebuilding and modernizing of the rest of the world. However, until the war is won, that huge task must be held in abeyance. Grim and immediate realities come first and the tool engineers are wading into them with sleeves rolled up and with nothing else in view except victory at the earliest possible moment.

Shipbuilding Takes 20 Per Cent of 1942 Steel Production

SHIPBUILDING, one-time laggard of the steel consuming industries, last year soared into premier position and replaced the automotive industry as the No. 1 customer.

From only 2 per cent of total production in 1940 to 4.4 per cent in 1941, merchant and naval vessel construction last year required approximately 20 per cent of all steel made.

Ship construction in 1940 required only 940,000 tons of steel; in 1941, 2,733,000 tons were used. Last year, however, approximately 17,000,000 tons were required.

During the closing months of the year, cargo ships were being launched at the rate of three a day. September production alone approximated that for the entire year of 1941.

Warships were sliding down the ways at a rate or more than one every three days.

The transition from requirements for light steel products for automotive and other durable consumer goods to the heavier rolled products for ships and other ordnance materiel necessitated drastic changes in steel mill operations. Particularly was this reflected in the conversion of continuous wide strip mills to the rolling of plates.

Nearly half of current shipments are being rolled on converted strip mills. For example, of October shipments of 1,101,382 tons, 536,981 tons were rolled on converted strip mills, 449,895 on sheared plate mills and 114,506 on universal plate mills.

Shipments of plates for the first ten months aggregated 9,736,300 tons, as follows:

Month	Net Tons
January	754,522
February	758,723
March	878,726
April	895,971
May	1,012,194
June	1,050,962
July	1,124,118
August	1,097,866
September	1,061,836
October	1,101,382

Shipments during November and December approximated those of October; January shipments are scheduled at a higher rate.

Despite restrictions in plate supply during the early months of the year, numerous records for speedy construction were established by the shipyards and attainment of the President's goal of 8,000,000 tons of merchant shipping for 1942 was near achievement.

Sensational speed records were set up by the Henry J. Kaiser shipyards on the West coast by first launching 10,500-ton ship in ten days after keel-laying, and later launching a similar vessel in 4½ days after keel-laying. The second

(Official Photo U.S. Army Air Corps)

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vessel was 91 per cent complete when it hit the water, and was ready for trials two days after launching.

Speed records accomplished in cargo ship construction were made possible by simplification of design in the new Liberty ships and by greater use of welding and prefabrication. Large sections of the Liberty ships were assembled in shops adjacent to the shipyards. Handling of these sections often was facilitated by use of dry docks built for complete ships.

In addition to the new ship construction programs, the yards have undertaken an unprecedented repair and conversion program. Since the government started taking over merchant vessels for conversion into troop transports and other types of naval auxiliaries, repair yards have been working day and night. To this large volume of domestic work was also added a large volume of repair work for British vessels, cargo and naval, in United States yards.

Repair yards were called from a state of sporadic peacetime activity to a full-blown expansion, paralleling that of the new construction industry, and increased employment 400 per cent over 1940.

Hundreds of merchant vessels have been armed with antisubmarine and anti-aircraft guns. A number of sabotaged Italian and German vessels seized at the outbreak of the war in American ports were reconditioned and placed in United States service.

On the Great Lakes, Pittsburgh Steamship Co., United States Steel Corp. subsidiary, launched five new 639-foot ore carriers, adding a total of 93,000 tons trip capacity to the ore fleet.

Construction of 16 freighters for account of the Maritime Commission was started and several of the vessels were launched during the fall.

Landing ships for tanks and submarines also were constructed and launched at inland yards. Some of these vessels already have been in service in the southwest Pacific and Atlantic war areas.

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Steel Fabricators Facing Lean Year; Backlogs Dwindling

STRUCTURAL steel fabricators and rolling mills enter a lean year; for the former, 1943 will plumb the depth of the lowest depression years. The industrial war plant for World War II has been built. Backlogs of construction steel, dwindling steadily for six months, will be virtually exhausted by April; only the tag ends of the war-building program are unfabricated.

With all new construction and heavy engineering projects sharply restricted, and the few likely to be approved stripped to the bone as to steel, fabricators are readjusting operations to new and different phases of the war, notably ship building or miscellaneous war equipment assemblies more directly connected with combat needs. Fabricating shops unable to fit into this program are confronted with suspensions, at least temporarily.

Production of plain material will be less drastically affected. However, rolling mills also face a rather pronounced recession in tonnage. Shipyards will absorb the bulk of tonnage, but will not take up the slack in other directions. Structural mills rolled approximately 5,000,000 tons in 1942, production being slightly over 92 per cent of capacity. Per cent of operations on plain structural material this year is not expected to surpass 60-65, although production of other products, shell rounds for instance, may occupy some units at a higher level at times.

Contracts for fabricated structural steel this year may be the lowest in a

STRUCTURAL STATISTICS

(American Institute of Steel Construction)

	1942	1941
—Bookings—		
January	183,387	281,235
February	228,688	173,559
March	248,319	206,072
April	313,953	218,018
May	161,039	179,884
June	184,516	246,910
July	125,243	214,756
August	80,605	158,658
September	68,520	158,782
October	46,811	128,658
November	50,000*	184,043
December	49,000*	146,379
Total	1,740,000*	2,296,954
—Shipments—		
January	167,753	164,590
February	164,599	161,354
March	191,262	170,161
April	187,205	189,751
May	184,162	191,905
June	182,699	200,509
July	189,937	203,026
August	173,899	189,251
September	169,837	204,085
October	146,648	217,738
November	140,000*	182,593
December	140,000*	176,126
Total	2,038,000*	2,251,089

*Estimated.

quarter of a century, below 1932, when monthly bookings averaged 79,000 tons; and low point of the drab year, 1907, will be approached.

American Institute of Steel Construction members booked about 1,740,000 tons last year and shipped 2,038,000 tons. Both bookings and shipments were below 1941, when they were 2,296,954 tons and 2,251,089 tons respectively. Thus the structural steel fabricating industry, one of the first to feel impact of war, substantially completed the nation's war plant before Pearl Harbor. That event brought about a supplemental program of construction which carried through the second quarter of 1942; for several months previous to the entrance of the United States in the war, contracts for fabricated structural steel were on the decline. Since July, 1942, new contracts have been declining steadily. Excess of deliveries over bookings since have steadily made inroads on backlogs.

This heavy and concentrated demand on structural mills and fabricating shops for the more protracted original war-plant program, 1941, and feverish supplemental needs for six months after we entered the war, were met with no increase in rolling or fabricating capacity. A large excess potential production capacity exists under normal conditions; the strain of war has been successfully withstood. At times, demand restricted supplies of plain material for the growing shipbuilding program, and at mid-year, plain shapes for a few weeks became tighter than plates. This was short-lived. The situation became serious when a peak in demand for building requirements was being surmounted; under directives, heavier rollings and concentra-

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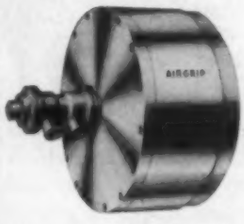

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tion on ship needs, deliveries improved materially.

Currently, deliveries of plain material can be made in four to five weeks. Production of billets for structural mills are under allocation. Rollings will be confined substantially to smaller and lighter sections indefinitely; few heavy beams, girders and columns are required in imminent construction schedules. Limited amount of bridge building to be approved will curtail plate girder work; until bridge construction came nearly to a standstill, there was a notable trend toward longer and heavier plate girders in bridge work.

TOTAL VALUE OF CONSTRUCTION CONTRACTS

(F. W. Dodge Corp. Reports—37 Eastern States)

Classification	1941 Act. Millions of Dollars	1942 Estimate Millions of Dollars	1943 Estimate Millions of Dollars	% Change from 1942 Est.	Yearly Average 1920-1939
Commercial Buildings	471	290	225	—22	488
Manufacturing Buildings	1182	2275	900	—60	279
Miscellaneous	663	1240	660	—53	693
Total Non-Residential	2316	3805	1785	—53	1460
Apartments, Hotels, Dorms.	258	190	300	+58	596
1 and 2-Family Houses	1560	985	400	—59	757
Other Shelter	136	595	300	—50	....
Residential	1954	1770	1000	—44	1353
Total Building	4270	5575	2785	—50	2813
Total Pub. Works and Utilities	2738	2340	1250	—47	962
Total Construction	6008	7915	4035	—49	3775

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Only a few of the bridges needed for access highways to military camps, depots and government establishments have been built; apparently few will be. Work has been halted on several large spans. For the Alaskan highway, moderate tonnages of bridge steel are required. Railroad bridge construction is restricted to vital necessities and repairs, considerable potential tonnage for railroad bridges having been held in abeyance. Freight cars will require moderate tonnages of shapes, but new cars will be confined to fixed types of rolling stock; 20,000 have been authorized for construction during the first six months, with no passenger units among them.

Steel needed for synthetic rubber plants will be less than expected because buildings are designed for minimum amounts of metal. Wood and concrete are substituted where possible. Plants already under way have had original steel estimates reduced. This is apparent in construction of other new war plants; ten detinning and can-stripping plants are designed for wood frame. Considerable steel equipment will be used in these new rubber and detinning plants, but structural shapes will be cut to the irreducible minimum. Wood columns have even been used in bridge crane construction, except runways. Deliveries of heavy timber and many grades of wood have tightened under this demand. Actually, steel deliveries are ahead of wood.

Substitution of wood for steel in wartime construction has raised the question of post-war competition and recovery of markets. Steel fabricators are not unduly alarmed as to timber and plywood, but structural aluminum is another matter. Cheap aluminum could compete with steel in building and heavy engineering.

Expansion of aluminum production at the end of the war will be tremendous. A large part of this capacity will be located near low-cost power, produced by government plants. The natural assumption is that aluminum plants will get cheap power. The government may be

anxious to maintain consumption of power from its plants. Low-price aluminum might well be competitive with steel for more uses in the structural field. Magnesium occupies a like position.

With fabricating shops getting into the war program on miscellaneous assemblies, pre-fabricated ship parts and tank bodies, the influence of welding is evident. Those better equipped with welding tools more readily get contracts; welding machines are worked overtime at capacity, while much punching and riveting capacity is down. Flame-cutting of special shapes is also being done to a greater extent by shops so equipped.

Should competition develop from aluminum, the influence of welding will be felt. Welding of structural steel has been proved; welding of structural aluminum has not, although punching and riveting is simple for most fabricators. Low-alloy high-tensile-strength steels would meet aluminum competition, but the price of aluminum in structural shapes is likely to determine the extent it enters the structural field in competition with steel.

On a much reduced scale, the industry will depend entirely on government authorized construction this year. Relatively few small projects will go ahead. In 1942, close to 85 per cent of contracts resulted from direct government requirements, 80 per cent for war plant expansions. Government-financed bridges accounted for but 2.2 per cent, and government engineering projects 0.5 per cent, compared with 9.6 and 6.0 per cent the previous year. Private industrial buildings dropped to 7.6 per cent of total bookings and public utilities to 1.8 per cent, a total of 9.4 per cent, compared with 13.5 per cent in 1941. Tonnage derived from these sources will be even less in the months ahead.

Average Job Larger

Average size of the individual job has increased. Projects taking more than 1000 tons each increased to 65.4 per cent of the total volume from 55.1 per cent in 1941. Only 20 per cent of the contracts are for less than 500 tons each, compared with 30.8 per cent of the total earlier in the war building program, or 1941. Private building currently is less than 15 per cent of all construction. This will fall steadily as the war goes on.

At midyear a pinch developed in plain structural steel, resulting from the final peak for war plant construction and increasing ship requirements. By increasing rolling schedules and billet allotments to close to 500,000 tons a month, this situation was relieved. Rolling schedules began to recede at just over 400,000 tons in October. Capacity of structural mills is more than ample to meet any unforeseen demand, the peak demand actually having been passed six months ago.

In dollar volume, construction awards continue high, for substantial Defense Plant Corp. contracts are still being placed, but use of fabricated steel is cut to the bone. Also a relatively larger percentage of DPC contracts are for supplemental equipment. The storage and warehouse phase of the war building program is nearing completion.

Of the total tonnage of structural steel rolled in the last 12 months, approximately 5,000,000 tons, a smaller ratio than usual was handled by structural shops, around 2,000,000 tons, roughly two-fifths. Largely responsible for this larger volume by-passing the shop fabricator are the ship yards which now are taking the largest tonnage in history; lend-lease is also a factor. Ships especially will maintain demand indefinitely. Bona fide structural shops probably have around 2,500,000 tons annual capacity. The industry as a whole has averaged 80-85 per cent of capacity in the last year, with heavy backlogs through most of 1942. Shipments have consistently been higher than bookings since June. Many shops were operating near capacity until third quarter.

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government war program is out. This includes non-military construction for the federal government. Changes in war needs have already halted some projects originally approved, including a large ordnance plant expansion at Hammond, Ind., for the production of large steel castings. WPB has drastically curtailed construction to make materials available for direct military use and for such essential programs as high-octane gasoline rubber, aviation, aluminum and alloy steel expansions, some of which are nearly completed. New construction must balance with production programs which are subject to revision from time to time as our troops enter combat. Some expansions which cannot be completed in sufficient time to warrant the expenditure of critical materials are being suspended, although work may have actually started, as was the case at Hammond, and a rubber plant at Gary, Ind.

Exclusive of ship building, volume of construction and heavy engineering projects scheduled for the war program in 1942 will decline more than one third. This, combined with the employment of methods and design to economize on steel, will reduce structural orders to under 1,000,000 tons, ships excepted. A larger volume of building than heretofore will also comprise miscellaneous work of a special character, rather than normal construction. In view of the definite outlook, unless fabricating shops can get contracts for work directly for the war effort, many will be idle or operating at the lowest rate in many years.

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Materials Shortages Hinder Railroads' Building Program

RAILROADS are fairly well prepared to uphold their wartime responsibility, despite the fact their program for building new equipment has been seriously limited through critical shortages of materials. Late last year, a program for new rolling stock and maintenance of lines for early 1943 was approved, and, although not as broad as had been sought, it appears reasonably adequate, providing the level can be extended throughout the year. At the same time, WPB appears to be giving greater recognition to the nation's No. 1 civilian industry and indicates that additional assistance will be given if needed.

During the past year, the country profited by the carriers' foresight in getting their facilities in good order in 1940 and 1941 in anticipation of the transportation strain which loomed ahead. Had the roads delayed this rehabilitation until the crisis was upon them, the story would be different today, for steel supply could not have accommodated transportation requirements without sacrifice to production of war goods.

No shortage of transportation has occurred and none is anticipated if the present building program carries through, although priorities may become necessary in passenger traffic, since no new passenger equipment is being built. Increased freight and passenger traffic, with higher rates granted early in 1942, improved the financial position of the

RAILROAD STATISTICS

	Net railway operating income (000 omitted)	Freight car-loadings (000 omitted)	Freight cars ordered	Steel rail production (net tons)
1930....	$ 869,000	45,878	46,356	2,098,021
1931....	526,000	37,151	10,884	1,296,681
1932....	326,000	38,180	1,968	450,874
1933....	474,000	29,220	1,680	466,252
1934....	463,000	30,846	24,602	1,131,451
1935....	500,000	31,504	19,308	796,921
1936....	667,000	36,109	64,523	1,366,228
1937....	590,000	37,670	51,611	1,619,228
1938....	373,000	30,457	16,303	697,642
1939....	589,000	33,911	57,775	1,312,647
1940....	682,000	36,354	66,889	1,678,986
1941....	1,000,000	42,279	121,499	1,902,766
1942....	*1,160,000	†39,984	*25,893	‡254,814

*10 months. †11 months. ‡Figures withheld starting with March.

railroads to the best level in many years. At the beginning of 1942, the carriers were embarked on a substantial building program which had to be curtailed step by step later in the year as materials became scarcer, and the need for ships and weapons of war expanded by leaps and bounds.

The shortages of materials for construction of new equipment and maintenance and repair of old constituted the chief problem faced by the railroads last year. Steel and other metals were obtainable only under priority ratings or direct allocations, and, when supplies grew critical, limitation orders had to be imposed on the building of equipment. To get a clear picture of the situation, it is necessary to review the priority and limitations orders as they were issued.

Six months before the United States entered the war, the first priority order, P-8, became necessary. Effective June 18, 1941, it applied an A-3 rating to materials entering into freight car construction. This was later extended to Dec. 31, and subsequently to March 31, 1942.

P-20, effective July 21, 1941, established an A-3 rating on materials for construction of specified locomotives. Extended to Dec. 31, 1941, and later to March 31, 1942.

Production Restricted

P-21, effective July 21, 1941, provided A-3 rating to materials for repair and rebuilding of steam, electric or diesel locomotives, whether for railroad, mining or industrial use. Extended to Dec. 31, and later to March 31, 1942.

P-88, effective March 17, 1942, assigned A-1-a rating to materials needed for emergency repairs upon specific approval of WPB; A-3 rating for materials essential for track, structures, signal and train and locomotive repair and operation, including perishable tools; A-8 rating on all other maintenance, repair and operating supplies. Use of A-3 and A-8 ratings controlled by quarterly inventory statements submitted to WPB. Ratings for raw materials and quantities thereof also determined by WPB on quarterly basis. This order was amended effective June 17, 1942, to provide A-1-j rating to materials essential for track, structures, signal and train and locomotive repair and operation, including perishable tools.

Limitation orders included the following:

L-97, effective April 4, 1942, froze finished locomotives in producers hands and prohibited production except in accordance with schedules issued by WPB.

L-97-a, effective April 4, 1942, applied the foregoing regulations to railroad cars.

L-97-a-1, effective April 29, 1942, canceled A-2 or lower ratings on mate-

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rial for freight car construction. Builders permitted to sell any material to other builders or railroads.

L-97-b, effective Aug. 8, 1942, required WPB authorization for production or delivery of railroad type industrial cars.

During the last three-quarters of 1942, building of railroad equipment and laying of rail was permitted only with WPB approval, and with materials made available by direct allocations, priority ratings no longer being effective in commanding supplies. Plates constituted the principal shortage, and this in spite of the fact that plate production was increased sharply in the first quarter through conversion of continuous sheet mills to rolling of the lighter gages of plates suitable for freight car construction. This move, expected to solve the railroads' plate problem, failed because in the meantime demand for plates for other war goods production had risen so rapidly as to preclude enough steel for car needs. Other rolled steel items, steel and malleable castings, and nonferrous metals, became equally as tight, and forced limitations on their use by the carriers.

The railroads found themselves faced with this situation in spite of the fact that late in 1941 they tried to forestall serious metal shortages by adopting a program which called for limiting new construction to certain current designs, substitution of other materials for scarce materials wherever possible, use of carbon rather than alloy steel in locomotives, and smaller-sized steel plates. In 1942, some carbon steels were almost as difficult to obtain as alloy steels.

Continuing the start made in 1941, locomotive and equipment makers turned more and more to the production of war goods and ordnance items, such as tanks, guns, gun carriages, bombs, shells, and similar products. This conversion offset, either completely or partially, the loss in output of their regular lines.

Always regarded as an important consumer of iron, steel and other metals, the railroad industry probably accounted for a substantially reduced percentage of the total output last year. No specific figures are available, but this would seem to be true since less equipment was built and less rail was laid. Railroad and equipment industries in 1941 took 9.1 per cent of all finished steel shipped, as compared with 8.2 per cent in 1940 and 9.29 per cent in 1939. Under average conditions, the carriers estimate they utilize about 17 per cent of the country's iron and steel output. This, however, includes gray iron, malleable and steel castings, as well as finished steel.

Freight Car Orders Drop

Domestic freight car orders in 1942 dropped sharply as a result of steel shortages and the curtailed building program. For ten months they aggregated 25,893, compared with 110,871 in the corresponding period of 1941. The 1942 total, therefore, will be the smallest since the 16,303 in all of 1938. For the first six months of 1942, awards averaged 3834 units monthly with a top of 11,725 in February and bottom of none in June. Average for the succeeding four months was 1444 units, with none ordered in August and October. Average for the ten months was 2587 units per month.

Reflecting the shortage of steel and other materials and restrictions imposed on the construction of rolling stock last year Class I railroads put 58,346 new freight cars in service in the first ten months of 1942, compared with 64,680 new units in the corresponding 1941 period. This figure breaks down into 33,848 box, 20,832 coal, 1814 flat, 619 refrigerator, 100 stock, and 1133 miscellaneous.

New freight cars on order Nov. 1 totaled 30,004, compared with 80,504 on the same day a year ago. Included were 9721 box, 16,608 coal, 2167 flat, 800

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refrigerator, 200 stock, and 508 miscellaneous.

During the same ten-month period, Class I carriers installed 638 locomotives, of which 258 were steam and 380 were electric and diesel. Through Oct. 31, 1941, they put 493 new locomotives in service, of which 117 were steam and 376 were electric and diesel. New locomotives on order Nov. 1 totaled 779, including 289 steam and 490 electric and diesel.

Rehabilitation of unserviceable equipment was pressed during 1942 because of the increased traffic load and the restricted building of new rolling stock. With 88,782 freight cars, or 4.7 per cent of the total, awaiting repairs on Dec. 31, 1941, only 59,817, or 3.0 per cent, were in this category on Oct. 1, this being the latest figure available. This was the lowest percentage on record; as far back as 1917 the figure had not fallen below 5 per cent. Bad order locomotives at the end of 1941 numbered 7212, or 17.2 per cent of the total. By Oct. 1 last, the figure had been reduced to 5189, or only 12.3 per cent.

During the first nine months of 1942, freight cars permanently withdrawn for sale or demolition because of obsolescence totaled 29,194, against 48,846 in all of 1941. Locomotives retired for the same reason numbered 1001, compared with 1200 in the year before.

Designs Limited

Efforts to relieve demands on locomotive power by substitution of diesel switches for lighter road engines now employed in yards have not worked well.

Car builders have been asked by the transportation equipment division, WPB, to confine construction of gondolas, hopper and flat cars to seven approved designs recently discussed by builders and government officials. These designs include two 50-ton composite gondolas, 50-ton and 70-ton composite hoppers, and 50-ton and 70-ton flat cars; designs for composite type box cars will be announced soon. The new designs substitute wood for metal where possible.

In late November, transportation division, WPB, outlined a program, as determined by the Requirements Committee, covering deliveries for railroads over various periods in 1943, as follows: Steam locomotives, 250, for delivery in first eight months; road diesels, 36, in first eight months; switching diesels, 100, for first six months; freight cars, 20,000, for first six months; passenger cars, none. For first quarter, plan provides 330,000 tons of steel for repairs to equipment, 480,000 tons of rails and 288,000 tons of track accessories. Announcement was made to allow railroad executives to outline their programs and place orders for rails and equipment at once to assure delivery early in 1943.

On the basis of this program, allocation of steel for maintenance of equipment and lines for first quarter total 1,098,000 tons, and if this pace is continued throughout the year, annual requirements would aggregate 4,392,000 tons. Railroad officials believe the figure will not be maintained the entire year, as WPB wants the new rails to go down quickly, hoping for old rails for scrap. Consequently, they calculate about 1,000,000 tons under the yearly estimate.

The 20,000 freight cars, at 25 tons each, amount to 1,000,000 tons of steel if the six-month program is doubled. Further, 450 locomotives, at 250 tons each, equal 112,500 tons of steel. These three groups add up to 4,504,500 tons.

The railroads had asked WPB to provide 6,650,000 tons of steel in 1943. They sought 80,000 cars and received approval for 20,000 with a prospect of this being the actual quarterly figure, although buildable over six months. They asked for 900 locomotives, received approval for only 350, but if equalled on the basis of a year, have a prospect for

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450. They obtained in trackage and other material about what they asked for.

Although the carriers submitted their requirements on an annual basis, WPB approved only part of it to give the agency time to see how the rest of essential steel demands actually shape up under the new Controlled Materials Plan. It was intimated, however, that if more equipment should be needed, materials to build it would be forthcoming. This indicates a changing attitude in WPB and the armed services to a recognition that adequate railroad operations are vital to winning the war.

Demand for rail was heavy in 1942, but needs were not fully satisfied because of steel shortage and prohibitions which WPB imposed on its manufacture. Production of rail in 1941 totaled 1,902,766 net tons, but information was withheld starting in March, 1942, at which time the two-month output was 254,814 tons. It is known, however, that the carriers were allowed only 1,260,000 tons, compared with the normal annual consumption of 1,370,000 tons.

The financial position of Class I railroads was appreciably improved in 1942 over recent years. For ten months, net operating income totaled $1,159,921,260, an increase of 36.4 per cent over the $850,021,279 in the same period of 1941, and $1,000,260,000 in the full year. Every month of last year, with the exception of February, registered a sharp gain over the preceding month, and all months showed wide margins over the corresponding months of 1941. Income ranged from a low of $66,490,000 in February up to $184,680,000 in October.

A part of the improved earnings, of course, came from increased freight rates of from 3 to 6 per cent made effective March 18, and 10 per cent higher passenger fares effective Feb. 10. The 6 per cent freight increase applied to finished steel and products, the 3 per cent to furnace slag; 4 to 6 cents a gross ton was added to coal and coke. Iron ore rate was not changed.

On Dec. 5, however, James F. Byrnes, director of economic stabilization, and Leon Henderson, price administrator, petitioned the Interstate Commerce Commission to rescind these $500,000,000 annual rate increases on the grounds that rail earnings have improved to the point where satisfactory profit positions can be maintained without the increases, and the increases jeopardize the anti-inflation program by "imposing unnecessary costs upon the users of railroads."

Freight Traffic Higher

Freight traffic last year showed an improvement of about 32.6 per cent, amounting to approximately 630,000,000,000 ton-miles, compared with 475,000,000,000 in 1941. Passenger business was estimated as likely to reach 53,000,000,000 passenger-miles in 1942, which would be a new record, topping the 1920 total of 46,849,000,000 passenger-miles. Both divisions are expected to increase 15 per cent in 1943. It is understood that 15 per cent of passenger coaches and 50 per cent of sleeping cars at year end were being used for movement of troops.

Surprisingly, freight car loadings in 1942 were only 1.9 per cent higher than in 1941. For 11 months, loadings aggregated 39,984,276 as compared with 39,233,794 in the corresponding period of 1941. Full year 1941 total was 42,279,000. As already pointed out, however, ton-miles of freight increased sharply 32.6 per cent. This was because several regulations issued required heavier loading of cars, some loadings were forbidden in favor of motor truck transportation, train lengths were increased and train movements covered greater distances and were speeded up. As the year closed, it was obvious that car loadings would be the highest for any year since 1930, but would not exceed the 45,878,000 in that year.

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Implement Builders Turn to War Goods To Utilize Plants

ENTRY of the United States into active participation in the war catapulted American agriculture into the greatest demand for farm products it has ever known. While this is giving farmers the highest income and buying power they have experienced, the effect upon the farm equipment industry is far less promising. Critical shortages in materials, principally steel, developed early in 1942, and in the end forced drastic curtailment in the production and sale of agricultural implements. Fortunately, a number of manufacturers had previously or subsequently converted their facilities to producing ordnance material or other war goods, and thus have been able to keep their plants operating at profitable levels.

Demand for farm products in 1943 is expected to expand to untold heights to satisfy war needs of this country, of the United Nations and of civilians, and the prospect is that requirements for some commodities will be in excess of agriculture's capacity to produce. Military and lend-lease purchases may take 25 per cent of this year's farm crops, as compared with about 13 per cent last year and 4 per cent in 1941.

Just as supplies of most farm products will be short, the number of new farm machines and equipment will be inadequate to meet demand, for steel and other metals continue sufficiently inadequate to permit manufacture of needed quantities. As in 1942, emphasis will be placed on keeping existing equipment in operation, and repair parts will be supplied in what is hoped will be proper

FARM CASH INCOME AND BUYING POWER

(Millions of Dollars)

	From Marketings	From Government Payments	Buying Power of Cash Income*
1929	$11,221	....	$ 7,330
1930	8,883	....	6,120
1931	6,283	....	5,070
1932	4,682	....	4,370
1933	5,278	$131	4,950
1934	6,273	447	5,460
1935	6,969	573	6,080
1936	8,212	287	6,850
1937	8,744	367	7,000
1938	7,599	482	6,630
1939	7,711	807	7,040
1940	8,354	766	7,400
1941	11,186	585	11,771
1942**	15,000	750	15,750

*Includes government payments.
**Preliminary estimate.

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quantities to insure its functioning.

An understanding of the embarrassing position in which farm equipment manufacturers find themselves because of materials shortages can be gained best by reviewing the various priority and limitation regulations which have been issued. The first priority order, P-33, issued Aug. 20, 1941, gave the highest civilian rating of B-1 to materials for new farm equipment, but almost immediately this proved not sufficiently high to provide the requirements. Another order, P-32, also effective Aug. 20, gave an A-10 for parts for repair and maintenance, and this worked reasonably well.

Throughout the closing months of 1941, SPAB considered a plan for making a "guinea pig" of the industry by providing materials for its needs by allocation. This was abandoned, however, in favor of higher priority ratings to secure materials for fixed quotas of certain types of new machinery. Consequently, P-33 was amended to provide an A-8 for new machinery and to extend the order to Feb. 14, 1942. This date corresponded with the expiration of order P-32 which gave priority assistance to repair and maintenance. Both P-32 and P-33 were revoked Dec. 27, 1941, on which date a new order P-95 was made effective, this assigning an A-3 rating to material for production of both new machinery and parts.

First limitation order, L-26, became effective Dec. 31, 1941, and restricted materials for construction of new machinery to 83 per cent of 1940 consumption and materials for repair parts to about 150 per cent of 1940. Priority order P-95 was revoked effective Sept. 1, 1942, because the assigned rating was no longer useful and most manufacturers were operating under the Production Requirements Plan (P-90) issued Dec. 3, 1941, and effective in the first quarter, 1942.

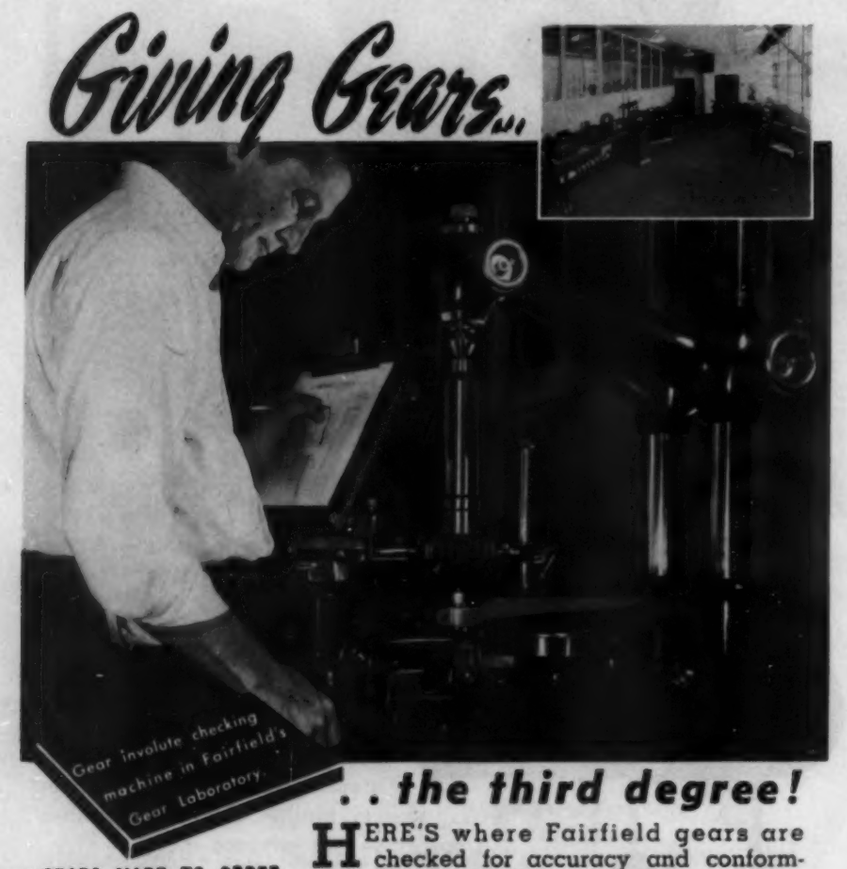
Next limitation order, L-170, effective Oct. 21, 1942, and granting the equivalent of an AA-3 rating, restricted manufacturing for the year ending Oct. 31, 1943, to 20 per cent for new machinery and 130 per cent for repair parts, based on 1940 or 1941 total, whichever was higher. L-170-a, effective Nov. 7, 1942, banned use of copper and copper-base alloys in manufacturing of farm tractors, engine power units or replacement parts other than for specific purposes.

Assigned AA-1 Rating

Late in December, WPB assigned the top priority rating of AA-1 to delivery of critical materials necessary to manufacture farm machinery included in the current program. This high rating will be applied to material for new machinery as well as for repair parts. Involved in the priority assignment are 218,900 product tons of steel for delivery in the first quarter.

Limitation order L-170, divides manufacturers into three classes—"A", "B" and "C"—depending upon the volume of their sales, and establishes quotas for each machinery item for each class by percentages. Without knowing basic sales for each class of producer, percentage ranges have no meaning. The idea, however, is to concentrate production with the smaller manufacturers.

Some idea of the scaling down in farm implement production can be gained from a comparison of the schedule for a few items in 1943 with the output in 1942. For example, tractors will be reduced to 37,000 from 170,000; one and two-row corn pickers, 5000 from 15,000; small combines, 17,000 from 36,000; grain drills, 6700 from 26,000, manure spreaders, 7130 from 46,000; and two-bottom tractor plows, 16,000 from 68,000. It is obvious that the percentages of reduction are not uniform, the quotas having been set on the basis of known needs for various types of machinery and the emphasis which is to be placed on various crops and agricultural products. Generally speaking, however, production is limited to about one-fifth of the nation's 1940 output. The Depart-



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ment of Agriculture regards the WPB limitation as too severe and maintains that a minimum overall production of 40 per cent of the 1940-41 output is necessary.

In addition to restrictions on manufacture, restrictions have been imposed on the distribution of equipment. For a period, sales of all farm machinery have been frozen, but this ban is now being lifted with the establishment of quotas, and sales are being resumed under the direction of county farm rationing committees.

Due to the restrictions which have been imposed upon them, the larger farm equipment makers are severely handicapped insofar as their normal line of product is concerned. One large company, for example, estimates its 1943 production will fall substantially below the 20 per cent of the 1940 average for the whole industry. On a tonnage basis, its output of new machines will be only 14 per cent of 1940, and 12 per cent of 1941. Consequently, its chief opportunity will be in supplying repair parts, which the government will permit to be made in about the same volume as in 1942.

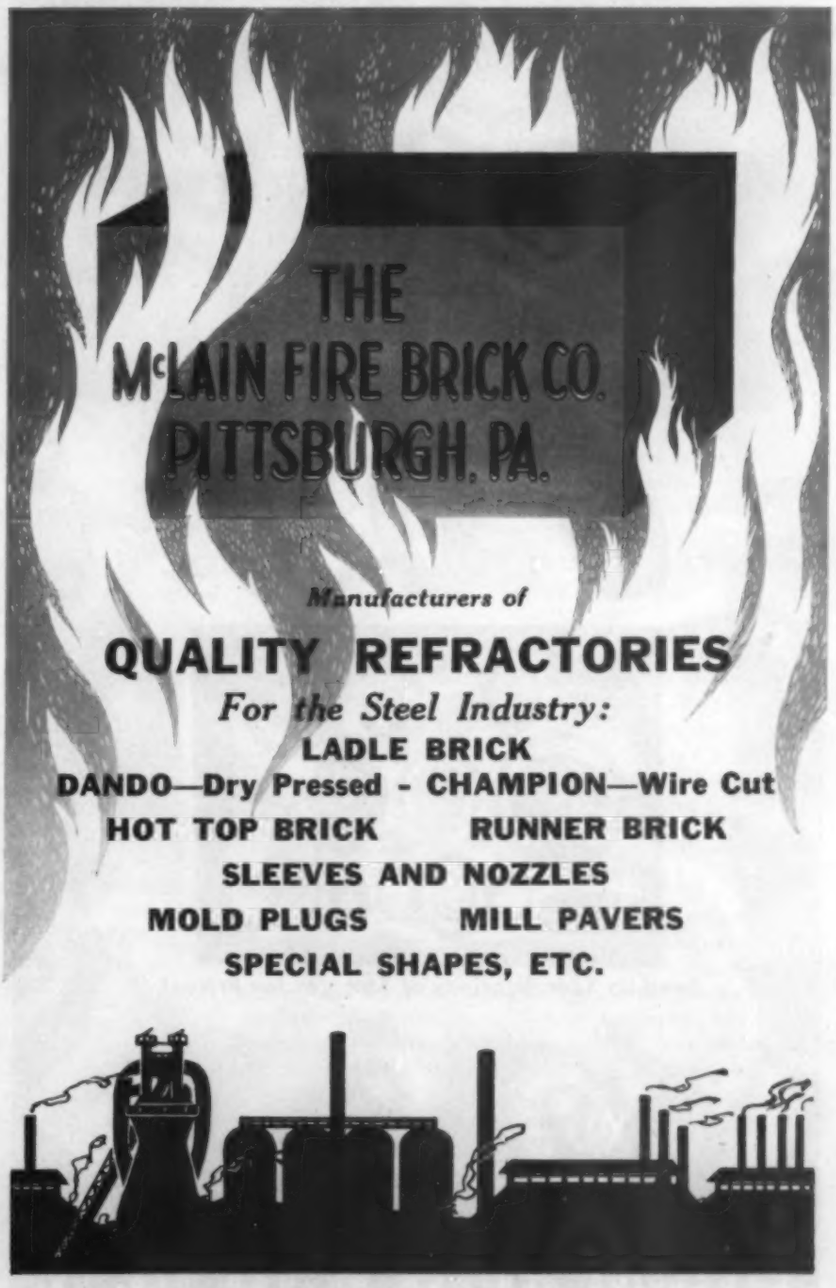
Orders Few and Simple

Government orders controlling prices of farm machinery have been few and simple in operation. At the outset of the war effort in 1941, agreement was reached between government officials and equipment manufacturers that prices would be held at then current levels. First official OPA price schedule issued was No. 133, effective May 11, 1942, which fixed retail prices at the Oct. 1-15, 1941, level. No. 246, effective Nov. 15, 1942, set maximum in effect March 31, 1942, and permits adjustments for items changed in design or specifications, or equipment introduced since that date.

Domestic farm equipment sales last year are believed to be somewhat below the 1941 volume of around $690,000,000, due to the curtailment in production of new machines. This favorable showing is attributed to the fact that inventories were not included in the 83 per cent of 1940 limitation under which the industry operated through most of the year. Because manufacturers in 1941 had anticipated the threat of materials shortages and had stepped up production schedules accordingly, inventories carried over were substantial. The sale of these stocks served to hold the annual volume up. Oct. 31, 1942, however, found inventories practically exhausted, consequently the sales outlook for 1943 is definitely not good. Only cause for a more optimistic picture is the possibility supply of metals may ease to the extent that production quotas on machinery can be increased. But, if this should occur, it probably would come too late to do much good for either manufacturers or farmers.

Domestic equipment sales last year are estimated to be somewhere between the all-time peak of $690,000,000 in 1941 and the $488,322,100 in 1940. Prior to 1941, the top had been $507,000,000 in 1937. Exports in 1942 are believed to be at approximately the same level as 1941 and 1940, namely, $74,221,000. For the duration, however, reporting of sales by division between domestic and export has been discontinued. The 1941 tabulation of the Department of Commerce gave total sales as $765,269,819, against $562,543,971 in 1940.

Crop and livestock production in 1942 ran about 10 per cent over 1941, 21 per cent over the 1935-39 average, and was an all-time high. Growing conditions were exceptionally favorable and acre yields were expected to average about 6 per cent above any previous year and more than 28 per cent over the 1923-32 average. Area of harvested crops was about 348,000,000 acres, or 10,000,000 more than 1941 and 22,000,000 more than 1939, but about 16,000,000 acres below the all-time peak of 1932. Poultry and egg production last year was a new



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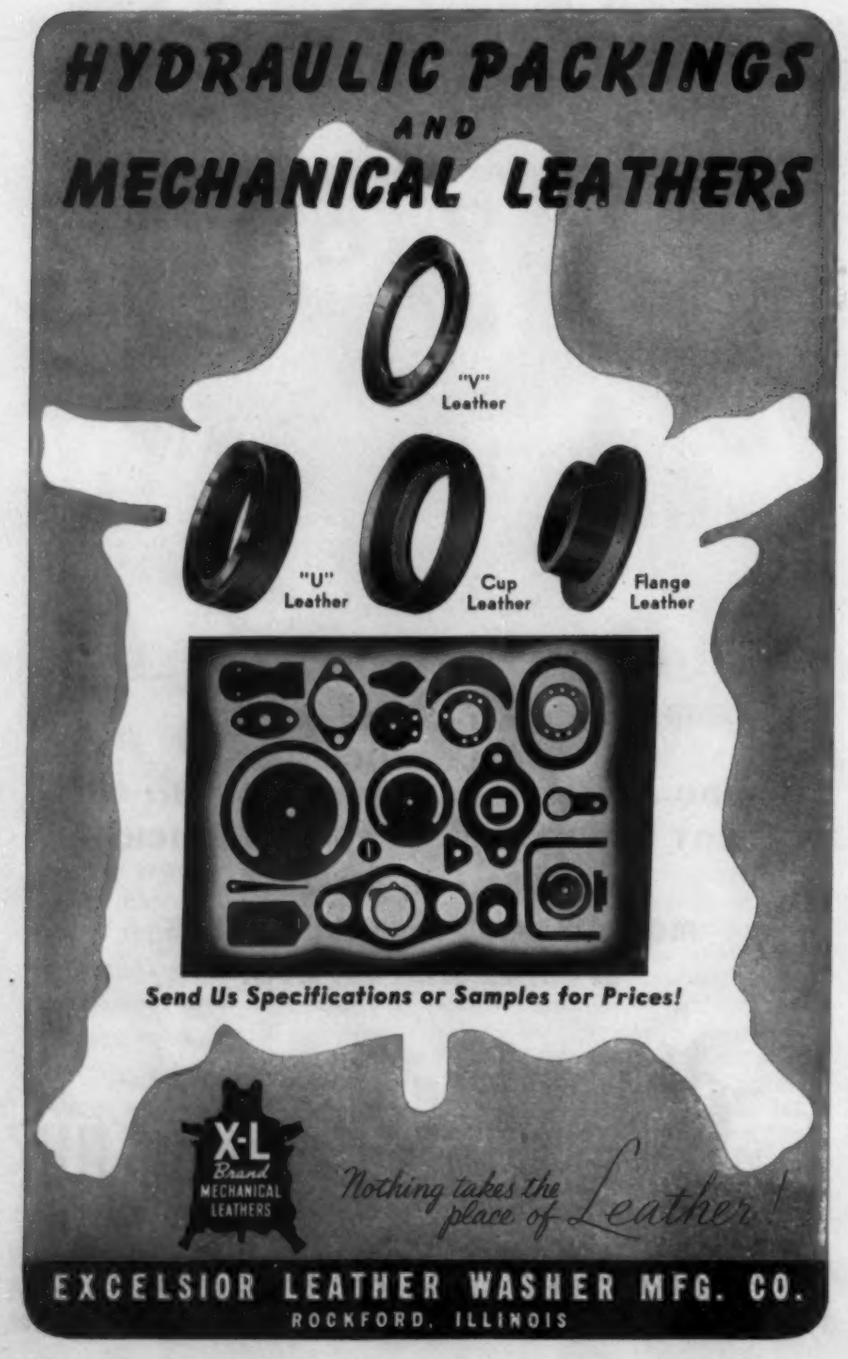
record. Dairy products were up 20 to 25 per cent over 1941.

Cash farm income in 1942 was estimated at $15,750,000,000, and was the best for any year in history, eclipsing the $11,711,000,000 record of 1941. This income was uniformly distributed over the country. Government payments, a comparatively important factor in the past four years, were estimated at $750,000,000, up sharply over the $585,000,000 in 1941, but somewhat below the record of $807,000,000 in 1939 and $766,000,000 in 1940. Experts cite as reasons for the one-third increase in cash income last year a 25 per cent rise in prices and a 12 per cent increase in sales. Buying power of cash income increased about 33.8 per cent because prices which the farmer paid for goods under the general price stabilization program rose less rapidly than income.

Assuming that prices this year average about the same as in September, 1942, cash income from marketings alone is forecast at approximately $16,000,000,000. This income is based on an assumption that production of livestock and livestock products will be slightly larger in 1943 than in 1942; and the total volume of crops sold will be somewhat smaller. With production and sales of farm machinery limited by quotas, this improved income will have little influence on equipment manufacturers, and through them upon the metals industry.

According to consumption statistics compiled by the American Iron and Steel Institute, agriculture, including implement and equipment manufacturers, accounted for 1.8 per cent of the shipments of steel in 1941, as compared with 2.0 per cent in 1940, and 1.9 per cent in 1939. On a tonnage basis, shipments were 1,153,678 net tons in 1941 and 919,502 tons in 1940. Tonnage and percentage of the total were probably down severely in 1942, because of the critical shortages and restrictions on farm machine manufacture.



Tin Shortage Spurs Electrolytic Plating; 26 Lines Under Way

UNDER complete war economy control as to production and use, tin plate output this year will approximate 2,650,000 tons. An estimated 2,625,000 tons of tin plate, exclusive of ternes and bonderized black plate for containers were produced in 1942, the industry operating at about 65 per cent of capacity, rolling and coating 55,000,000 base boxes. Practically all was cold rolled. Tin plate rolled and processed in 1941, a record year, totaled 3,222,472 tons; 2,856,259 tons cold reduced and 366,213 hot rolled. Including terne and black plate, slightly more than 4,000,000 tons were produced that year, mostly for containers.

Stimulated by the necessity of conserving tin, impetus is given the electrolytic process of coating; numerous installations of continuous lines will be-

TIN MILL OPERATIONS

Net tons

	Annual Capacity	Production	Per Cent of Capacity	Tin Plate Exports
1934	2,987,774	1,692,131	56.7	203,800
1935	2,829,407	1,856,908	65.6	148,077
1936	2,975,504	2,361,986	79.4	263,853
1937	3,317,216	2,758,294	83.2	396,860
1938	a1,827,791	675,745	37.0	†231,170
	b2,047,472	142,572	46.0	
1939	a1,710,643	645,301	37.7	†369,443
	b2,168,544	1,916,150	38.4	
1940	a1,201,960	422,028	35.1	†400,629
	b2,930,360	2,267,828	77.4	
1941	a 515,620	366,213	70.1	Not Available
	b3,542,040	2,856,259	80.7	
*1942	a 515,620	323,000	60.3	Not Available
	b3,542,040	2,277,000	65.1	

*Estimated; a—hot rolled; b—cold rolled; †both grades.

come progressively productive as the year advances. By the end of 1943 capacity for 1,400,000 tons will have been completed. There are delays and "bugs" in getting some of this capacity into production, which for the first quarter may reach 185,000 tons.

Only electrolytic plate rolled and coated by Sept. 1 will be available for 1943 packs, thus allowing eight months output of that type for the food program this year. In view of delays in delivery of electrical equipment, production of electrolytic plate the first eight months will approximate 950,000 tons, but from the second quarter on, output will be increased rapidly. By fourth quarter, 26 electrolytic continuous lines should be available for operation; there were but two in late 1941.

While there have been some unavoidable delays in getting these new installations into production, 14 units were operating, or will be soon for first half needs. Most of the other lines will be coating steel plate by mid-year. New units are designed to handle 36-inch coiled strips at better than 600 feet per minute. A much larger percentage of cans for the 1943 vegetable packs will be 0.5-pound coated electrolytically, relatively more hot-dipped, 1.25-pound coated, going to the armed services for certain requirements for which it is considered more suitable, including some foods.

Process Advanced by War

Electrolytic coating of tin on steel plate was pioneered for years before the outbreak of World War II, but that event brought the infant process to maturity in one year. Not only has the process come to the front, but equipment developed has already greatly improved; the two lines in 1940-41 handled 30-inch strip at about 300 feet a minute, half the speed of new units which also take a wider sheet.

Expansion in productive capacity of electrolytic tin plate adds a third dimension to specifications, namely the amount of tin deposit for specific containers, dependent on the pack, contents and use, supplementing size and finish of the plate, length, width, softness or toughness. Condensed milk, for instance, will take a 0.7-pound tin plate and milk powder 0.5-pound per base box.

With lighter tin deposits, 0.5-pound per base box for many cans, has come a better finished steel plate; thinner coating of tin, making it difficult to fill defects, has prompted and improved the steel sheet, and for some purposes an even lighter coating is possible. Nevertheless, some producers of tin plate hold the opinion some packs this year may

COOPERATION WINS THE WAR

WOLVERINE SALUTES
THE TEN WINNERS

In recognition of their noteworthy contributions to the war effort, ten men were invited to the White House on December 10 to receive individual awards personally bestowed on them by President Roosevelt.

In this ceremony, the first of its kind in the country's history, six of the workers, chosen from the war industries in cooperation with local labor-management committees, received Citations of Individual Production Merit, signed by Donald M. Nelson; and the four other workers received Certificate Awards.

Wolverine's salute to these men carries a deep feeling of pardonable pride because among them is one of our own men, Walter P. Hill, whose development of a new process of manufacturing primer tubes is now used in the firing mechanism of millions of large shells. Through his untiring efforts many worthwhile savings in critical materials have been effected, and great reductions have also been made in man-hours and machine time.

WALTER P. HILL
"Production Soldier"

The Citation Award winners, in addition to Hill, are: Joseph H. Kautsky, Link-Belt Co.; Clinton R. Hanna, Westinghouse Electric and Mfg. Co.; Edwin Curtiss Tracy, RCA Manufacturing Co.; Madison E. Butler, Stromberg-Carlson Telephone Mfg. Co.; and James A. Merrill, Goodyear Tire and Rubber Co.

Certificate Awards went to George Smolarek, Packard Motor Car Co.; Daniel Walter Mallett, Borg-Warner Corp.; Herbert Ruper James, National Tube Co.; and Stanley Crawford, RCA Manufacturing Co.

Men, you've done it! We're proud of you, and we are happy in the thought that you are receiving the public recognition you deserve. We hope your achievements will serve as stimulants to even greater employee participation in factory suggestion-box system, where more good ideas may be born and mature into helpful devices that will bring us an early peace.

CALUMET AND HECLA CONSOLIDATED COPPER COMPANY
WOLVERINE TUBE DIVISION
Seamless Copper — Brass
1439 CENTRAL AVENUE DETROIT, MICHIGAN

THREE MAJOR VEGETABLE PACKS

(In millions of cases)

	*1943	1942	1941	1940	1939	1938	1937	1936	1935	1934	1933	1932	1931
Tomatoes	30.0	33.0	31.5	29.6	18.5	23.0	20.5	24.0	15.7	13.1	12.0	16.0	9.6
Peas	33.0	35.5	29.5	25.5	16.3	24.5	23.3	16.0	24.6	15.7	12.9	10.4	13.3
Corn	25.0	31.0	23.1	16.3	15.3	20.8	24.3	14.0	21.0	11.3	10.2	9.4	19.4

*Estimated.

be endangered by too stringent restrictions on coating. Foodstuffs in numerous instances will be packed in containers bearing a smaller volume of tin than ever before and some uncertainty as to this exists. Not with canmakers, however, for with an extensive research organization, confidence is expressed tin coatings will be held within the margin of safety.

As 1941 was a record-breaking year for production, consequently it was a big can year, tin plate and can inventories mounting which influenced mill operations and canmaking in early 1942. This surplus of both has been worked down and production of both plate and cans this year will be closer geared to actual pack requirements and essential war economy needs, all strictly controlled from steel mill to consumer distribution.

While first regulatory orders affecting tin plate production schedules were directed primarily toward tin conservation, Far East supplies being cut off by the Japanese, revisions from time to time have taken into account tightening supplies of steel. Demand for ships and armor plate limits normal supply of black plate capacity and quotas for lighter products continue to be held down. This situation should improve for this year's production of tin plate with schedules and requirements more definitely fixed more in advance. Curtailment in use of tin will continue, production of bronzes taking more than will plate for cans.

Tin is the success story of the war. Before the war a shortage of tin gave the public much more concern than the possible shortage of rubber. Such prompt and drastic measures were taken in the week after Pearl Harbor that the use of tin was reduced greatly and quickly. On Easter Sunday (April 5, 1942) the Metals Reserve Co.'s Longhorn tin smelter came into production.

Stockpile Maintained

This combination of reduced use, plus new production on a moderate scale, has made it possible for us to maintain our substantial stockpile of refined tin. In fact tin is much less critical than copper and zinc, for example.

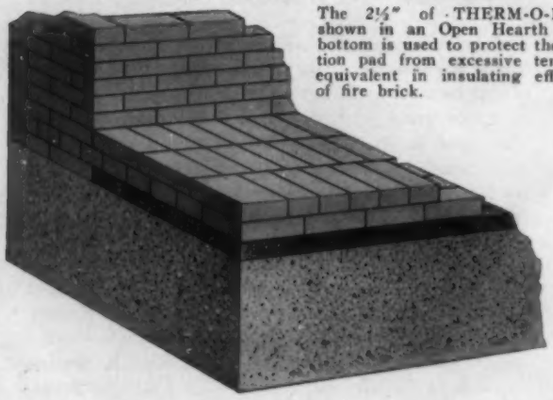
Technical problems inherent to new processes are attending the swing into electrolytic production, but completion of most units will be much in line with the demand for cans after April 1. Under the curtailed program, original construction schedules called for completions before part of the increased capacity will be actually needed.

The amended order covering food packs for 1943, while tightening restrictions as to the use of both tin and steel, does not differ materially from controls in effect during most of 1942. In general, special product cans are more affected and curtailed to a greater extent than food cans; a number of can sizes are eliminated for specific products, including odd size and intermediate type containers.

Tin coating specifications are reduced for some products, increasing emphasis on chemically treated black plate and electrolytic tin plate. Tin plate, terne and black plate are eliminated entirely for the packing of some goods. Other canned products previously packed for

Therm-O-flake
INSULATING CONCRETE

A Light Weight High Temperature Concrete with Double Insulating Value



The 2½" of THERM-O-FLAKE Concrete shown in an Open Hearth checker chamber bottom is used to protect the concrete foundation pad from excessive temperatures. It is equivalent in insulating effect to about 15" of fire brick.

Reduces usual insulating concrete thickness by about half.

Increases effective depths of flues and checkers in Open Hearth furnace construction.

Protects concrete foundation pads from excessive heat.

Allows increased magnesite thickness in Open Hearth bottoms.

Smooths surface irregularities on Open Hearth bottom pans.

●

Write for Information and Prices

Other Therm-O-flake Products

Made from Exfoliated Vermiculite

Granules - Coating - Brick - Block

Illinois Clay Products Company

JOLIET, ILL.

both military and civilian use are now limited to government purchase only. Orders affecting distribution of numerous packs to government purchase for military and lend-lease are more restrictive than the actual production of tin plate and cans. Varnishes, lubricating oils, disinfectants, germicides and insecticides may not be packed in metal containers and there are many others in the special product can group.

Approximately 10 billion metal units in the packaging industry may be eliminated, many in the special product field, from cosmetics to shoe polish. Packers of perishable foodstuffs will be less drastically restricted. A heavier percentage of permitted packs of some products will be put up in larger type cans and in the early weeks this year canmakers are fabricating only those small-size cans absolutely necessary for the maintenance of normal production schedules. Toward further conservation of metal for the 1943 food pack, an increase in the percentage quotas requiring the use of No. 10 cans is made and canmakers have been advised to keep inventories of small cans at a minimum.

Elimination of some smaller cans was accomplished in 1942 and at the same time canmakers increased production of No. 10's where possible, or about 65 per cent over normal. With present equipment this larger size can will probably be increased another 25 per cent this year, but that appears to be the limit, unless new machinery is installed.

Use Determines Tin Content

Although from 50 to 55 per cent of some major packs are being earmarked for the government, many quotas are unlimited or at least equal to last year. In terms of tin plate the order affects the distribution of canned goods to a much greater extent than in lowering demand for food containers. Bulk of cans containing packs for government use and distribution abroad are heavier coated than the 0.5-pound tin plate which will be utilized largely for civilian needs. With the percentage of many packs set aside for the Army, Navy, services and lend-lease higher, a corresponding volume of tin plate will be heavier coated, 1.25 to 1.50 pound to the base box regardless of tin conservation programs.

Restrictions of the WPB order are now in effect on all products packed on a calendar-year basis. In the establishment of packing quotas, tin plate area of the container is the controlling factor; a packing quota of 100 cases of No. 2 cans, 24 to the case, is convertible into a quota of 139 cases of No. 10 cans, packed six to the case, increasing

To every
WYCKOFF
Production Soldier
THIS BADGE OF MERIT

TYPIFIES THE GRIM RESOLVE TO PRODUCE MORE STEEL FASTER THAN EVER BEFORE!

WYCKOFF'S *victory* spirit won the coveted Army-Navy "E" and WYCKOFF'S *first* star for continuous outstanding production for the six months period after the first award! This latest recognition has added new impetus to our constant endeavor to produce more and more steel,—better and faster!

These Distinguished War Production Flags Have Been Awarded the Wyckoff Plants!

Bureau of Ordnance Flag and Navy "E"

All-Navy "E" Burgee Flag

Army-Navy "E" with *added* Star

WYCKOFF DRAWN STEEL CO.
FIRST NATIONAL BANK BUILDING, PITTSBURGH, PA.
3200 SO. KEDZIE AVENUE, CHICAGO, ILL.
Manufacturers of Carbon and Alloy Steels . . . Turned and Polished Shafting . . . Turned and Ground Shafting . . . Wide Flats up to 12" x 2"

the amount of food preserved 85 per cent; thus the trend toward larger cans.

Electrolytic tin plate when available is specified for the coating of more cans for vegetables and fish. Incidentally the fish and shell fish pack is encouraged, experiments with large herring and other species of seafood at Maine canneries during the last year having been successful. Fish pack may take 3,500,000 base boxes; meats 4,000,000 boxes. The pack of evaporated milk in 14½ ounce cans is cut 10 per cent below 1942 and in six-ounce cans 20 per cent. Ration cans for the services will take 2,400,000 base boxes; fruits 7,500,000.

By the end of this year, available electrolytic tinplate capacity should be approximately 60-65 per cent of the total, assuming deliveries of equipment are speeded. The extent this capacity will be finally utilized later in the year will be contingent on the success in application of much light-coated plate to the many canned products for which it has been approved. In some cases heavier coatings may be ordered, but they will be confined to lowest margin of safety.

Substantial increases in capacity for the manufacture and processing of bonderized sheets are in the making. There is more delay in completing these units and during the first half of 1943 at least, considerable of this new capacity will not be available. Demand for bonderized plate in the container field will probably fall short of first estimates; also there may not be as large a tonnage of sheets available for bonderizing as expected. Bonderized black plate, coated with protective lacquers, is finding use in the canning industry for can ends, and as a substitute in other directions, but restrictions and controls, extending to steel as well as tin, has tended to hold down earlier estimates.

Restricted use of tin plate has naturally opened many packaging fields to substitutes, paper, fibre, glass, lacquered metal, dehydration and frozen foods. Substitutes for the steel-tin can will continue for many purposes for the duration, but most, if not all, are not seriously expected to hold their markets at the expense of the metal can with the return of peace.

Food Packs Take 80% of Tin

Price and costs in most instances favor the tin can, notably for the processing of food, that industry still accounting for close to 80 per cent of all tin plate produced as in peace time. Beer canning for the civilian trade is out for the duration, but for the armies several million cans a month are produced. In the hot countries where the water supply is limited or bad, troops insist on beer for drinking with salt tablets. In addition to proving its worth as a container for beer, the tin can has saved much in transportation costs and handling for breweries. Yet canned beer did not materially cut into bottle sales, being an added package to the whole for home consumption.

Improvement is notable in dehydration of numerous food products, but even so, many still require protection from moisture in cans. Most dehydrated foods are now shipped abroad, contributing especially to the need of saving shipping space, but that they will enter the commercial field on a permanent basis is questionable. A great future for dehydrated food was predicted during the last war and failed to develop. As happened in the last World War, fabrication of cans has been restricted and directed into limited channels since the late months of 1941, increasingly so during 1942; canmaking will be 100 per cent controlled this year.

While special product steel containers have been eliminated by the millions,

THE "TOGGLEBUG"
PORTABLE DRILL

Builds ships, tanks, buildings, faster for the war effort. Wherever holes are required the Togglebug will speed production, save valuable handling and lay-out time and reduce manpower required to do the job. The Togglebug drills, reams and countersinks any size plate or structural section.

WRITE FOR ALL DETAILS

GUIBERT STEEL COMPANY

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the war has called for vast quantities of specialized tin-plated steel containers for hundreds of essential war supplies; first aid utensils, portable blood banks, emergency water supply, explosives and other powders and scores directly connected with front line requirements. As noted before, ration cans alone will require 2,400,000 base boxes.

No longer are the 95 different kinds of foods and beverages packed in steel containers with more than 300 variations as in 1941; many are packaged in cans only as required for government needs. This narrowing of use must be expected for the duration, but the necessity of preserving the nation's perishable food crops and increasing percentage of canned food supplies required for the armed forces and lend-lease make the packaging job of the steel can even more important than in times of peace. For lend-lease 14,000,000 base boxes of tin plate, taken last year, will be maintained.

The elimination of many special product containers, partly offset by the need for new ones for the military effort, may be put down as one of the war sacrifices of the civilian. Normally special product cans take but one-fourth of the steel required for the fabrication of containers. An increasing percentage of restricted special containers are being earmarked for government needs.

The can manufacturing industry, highly mechanized, with ability to produce immense volumes of containers, given adequate supplies of steel and tin, may be expected to regain, enlarge and widen its markets with the return of peace. When restrictions are lifted, when products and materials are again flowing freely into world-wide civilian distribution, the highly efficient, low cost, dependable tin can (it is mostly steel) will aid packers in solving post-war adjustments, regaining markets dislocated by the war. Contributing materially to this will be the progress of the steel industry in adoption of new and improved methods for production of better steel, better tin plate, during the war emergency. They have not yet tied a "tin can" on the steel container—far from it.

Anti-Fog Compound Keeps Goggles Clear

A new improved type of Anti-Fog lens pencil to help keep safety goggle lenses from fogging is announced by American Optical Co., Southbridge, Mass. According to tests, the new compound secures superior anti-fogging results for a longer period of time than former types. In addition, the pencil itself lasts longer without crystallizing and crumbling.

Castings' Importance In Munitions Work Amply Demonstrated

IMPORTANCE of castings as basic engineering materials for the construction of implements of war was demonstrated conclusively during the past year. As programs for the production of tanks, guns, planes, ships, trucks, machine tools and the other war needs were accelerated, enormous demands for various types of castings were directed at the foundry industry.

The record of achievement in meeting these demands, despite tremendous difficulties, is a glorious chapter in the history of that essential industry. Through conversion of facilities to meet particular requirements of the war effort, through expansion of plants or the construction of new foundries when existing capacity was not sufficient, and most of all, through applying ingenuity and experience to the production of greater quantities of castings with the plant and equipment available, foundrymen have

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WITH UDYLITE HARD CHROME
EQUIPMENT
You'll need this book
Under the present shortage of perishable tools it is no longer a question of "Shall we salvage our worn out tools?" The question is "HOW?" Udylite has the answer in a complete, efficient tool salvage installation for your own plant.
This modern, "precision-control," apparatus is so simple and fool proof that practically anyone can operate it. Drills, reamers, taps, dies, gauges and cutters may be plated to size, without subsequent grinding—PRE-SALVAGED to give them an initial life of from five to ten times that of the finest steel cutting edges. Worn PRE-SALVAGED tools may be stripped and replaced to serve again and again.
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had a great part in the remarkable record of achievement of American industry since Pearl Harbor.

Outbreak of war found steel foundries already loaded with high priority work, and new demands, especially for tank castings, adding to the backlog of orders. During the past 12 months new steel foundries have been completed, many plants have been expanded and a number of gray iron and malleable iron foundries have been converted to the production of steel castings through installation of converters or electric furnaces and the necessary heat treating equipment. It is estimated that the capacity for producing steel castings was doubled during the past 20 months.

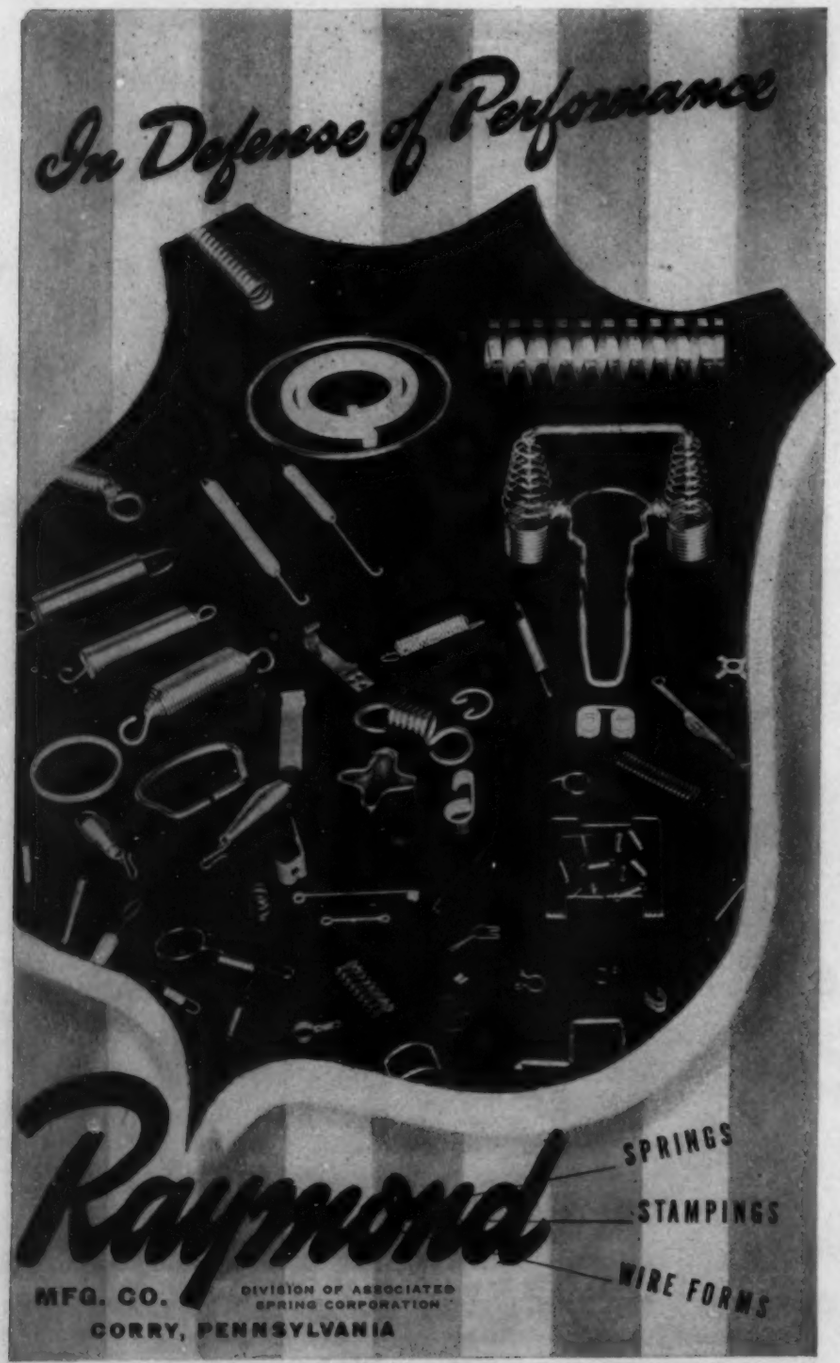
Gray iron foundries have increased materially the production of machine tool and other machinery castings since war was declared. However, shortages of pig iron and scrap, brought about by war production, resulted in limitation orders which stopped all civilian production early in the year and left many manufacturers of gray iron castings facing heavy curtailments in operations. By converting facilities and personnel to the production of those types of gray iron in which war demands exceeded production capacity, by developing new applications for gray iron in the war effort, and by converting to the production of other types of castings, such as steel, aluminum and magnesium, the great majority of gray iron foundries have continued to render great service to the war effort.

The malleable foundry industry has been doing an excellent job in assisting various departments of the government in the problem of substitution of malleable for other materials more difficult to obtain. As a result of this work, the demand for malleable iron for war work continues to gain.

In the nonferrous field, most brass and bronze foundries have been successful in converting to war work, and the remainder, due to shortages of metals, have had to close. In the field of aluminum and magnesium castings, an accelerated expansion of facilities is under way. Both brass and iron foundries now are revamping facilities to produce light metal castings, and numerous entirely new foundries are being rushed to meet the needs of the greatly expanded plane program for 1943.

Much of the foundry expansion program has been possible through the achievements of foundry equipment manufacturers in building machines and equipment. Producers of foundry equipment set an all time record in 1942, a record which probably will not again be equaled.

What is the outlook for the foundry industry in 1943? This depends entirely upon the demands of the armed services, as created by the developing offensive campaigns. An indication of this is to be found in recent weeks when shifting of production emphasis has had a pronounced effect upon the foundry industry. Doubling the airplane program has provided a heavy expansion in foundries to produce aluminum and magnesium castings. On the other hand, efficiency of plants producing tanks and tank parts has been so high that a number of steel foundry projects, many well along toward completion, have been held up. As this shifting of emphasis continues, foundries must be able to apply facilities to new production problems, as now is being done in the aluminum and magnesium fields.



1942 Boom Year for Heat-Treating Units

Demand for all sorts of heat treating equipment, as well as instruments and other accessories, shattered all records

in 1942. In the second half the flood of new business began to taper off and by the end of the year there was some doubt as to how much longer it would take to work off backlogs, also as to how much additional new business to expect. In November production of heat treating equipment was cut largely to that for two military programs, aircraft and ships. It is expected that it will require pressure well through February to take care of these programs. The extent to which programs that were suspended will then be revived is not yet known. In general, however, it is felt that the major portion of the gigantic war demand for heat treating equipment has been met, and that future new business will be largely in the nature of replacements or equipment to cure bottlenecks which are likely to result from changes or improvements in weapons.

Demand for Welding Equipment Recedes

AS was the case with most other lines of equipment, 1942 was the biggest year in history for the builders of welding equipment. As the war tooling-up period progressed, new demand for welding equipment began to taper off the latter portion of the year with deliveries at the year's end ranging two to twenty weeks depending on the particular type equipment. There were certain exceptions, as in gasoline-driven welders, whose production was slowed down by difficulty in getting gasoline engines.

One of the outstanding trends was the application of resistance welding machines on an increasing scale, made possible by the fact that the war program involves so much mass production, which justifies the expense of specially designed machines.

In arc welding there was tremendous acceleration due to the utilization of this method in shipbuilding. Arc welding also gained ground in aircraft construction due to development of new techniques and improved electrodes.

Use of the oxy-acetylene process reached a new peak; its status in the immediate future depends somewhat on the extent to which production of tanks is limited or expanded.

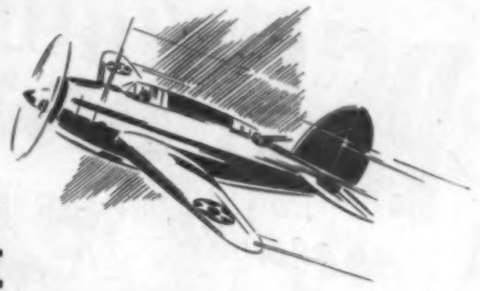
Tin is being produced at Trail, B. C., as a by-product of lead, zinc and silver mining operations sufficient to meet about 15 per cent of Canada's requirements, according to the Department of Commerce. Before the war no tin was produced in Canada.

Forging Presses Booked Through '43

PRODUCTION of all types of forging equipment was maintained at a record-shattering level all through 1942. Unlike the case in some other types of new equipment, there was no let-down toward the end of the year. In fact, producers at the end of December were scheduled for full 24-hour production at capacity through all of the 12 months of 1943. About the only change was a falling off in new demand, indicating the possibility that by the early months of 1944 the greater portion of the war demand may have been satisfied.

This condition was reported by representative manufacturers of drop hammers, forging machines, and mechanical and hydraulic presses.

The greater portion of the backlog of orders on books at the year's end was based on the vast forging requirements of the aircraft industry. The scale on which forgings are needed for this program can be appreciated when it is recalled that some 3200 forgings are required for a Flying Fortress, some 300



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easier • faster • cheaper with these ACP Products

Prime and sub contractors faced with the tremendous aircraft production goal will find help in ACP's years of experience.

DEOXIDINE, the acid cleaner that made the all-steel automobile body possible in mass production is now aiding in the mass production of aircraft. Prepares steel, aluminum and dural for painting, leaving an etched surface that holds paint perfectly.

KEMICK, a chemical paint that holds to and protects metal surfaces even when red hot, has been used for years the world over on mild steel exhaust manifolds . . . can eliminate stainless steel exhaust lines. FLOSOL wets oily surfaces, is an exceptional soldering flux for steel, brass, copper, tin, terne plate and zinc.

ACP has been working steadily on the treatment of metals for the Aviation Industry—and all industries . . . the knowledge of ACP technicians and chemists is available to you.

•

Other ACP Products that contribute to the war effort are: RODINE, the pickling inhibitor that saves steel and acid; CUPRODINE for producing tight, bright copper coatings on steel by simple immersion; LITHOFORM for coating galvanized iron to hold paint.

These are typical ACP Products. The experience of the ACP laboratories in metal treating and finishing processes is at your service.

AMERICAN CHEMICAL PAINT CO.

MAIN OFFICE AND WORKS AMBLER . . . PENNA.

ACP

DETROIT, MICH., 6225 Palmer Ave., E. CANADIAN BRANCH WALKERVILLE . . . ONT

for a bomber, some 200 for a fighter plane and so on.

Many manufacturers of forgings were complaining in the last half of the year about the shortage of die sinkers and declared that their die rooms were bad bottlenecks. This manpower situation at the year's end was approaching emergency status.

Mine Safety Appliances Co., Pittsburgh, was awarded the National Safety Council trophy at the Chicago convention as winner in the light machine shop group of the Metals Section.

Handling Equipment Backlog Is Heavy

PRODUCTION of all sorts of materials handling equipment was at an all-time high level all through 1942. Contracts were placed in the main over the first five months of the year. While new business after that was comparatively small the backlog had swollen to a volume necessitating capacity production over the remainder of the year and stretching out into or through the third quarter of 1943 in most cases. This new equipment is going into aluminum, alloy steel, synthetic rubber, high-octane gasoline and numerous other plants identified with war production. Under the priorities system all order books are frozen at least up to next June.

The foregoing applies to such fundamental equipment as cranes and hoists. There are some variations here and there. For example, orders for tramrail systems for plants to make certain types of weapons on which there now is less pressure have been cancelled, but on the whole, tramrail production schedules have been frozen for months ahead. There is heavy pressure for trucks of all types. The government contemplates acquiring at least 23,000 trucks in 1943 and the materials for their construction already have been scheduled through October. These trucks are mainly for air bases and for use in Army warehouses.

A large percentage of materials handling equipment shipped or booked during 1942 is being exported under lend-lease. Shipments to Latin American countries are substantial.

In addition to government orders, manufacturers have substantial orders on their books against which shipments cannot be made under the priorities system.

PSC Industrial Cars stay on the job—with minimum maintenance! These rugged high-capacity cars help you speed the production of war materials and give you top haulage efficiency.

Choose the cars best suited for your requirements from the rugged, dependable **PSC** Line.

Our descriptive bulletin should be in your files for ready reference.

PRESSED STEEL CAR COMPANY, INC.
(INDUSTRIAL DIVISION)
PITTSBURGH, PA.

Nonferrous Metals Capacity Expanded; Most for War Use

WITH demand for practically all nonferrous metals soaring to new all-time highs in 1942, distribution of these metals constituted one of the most important problems in the entire war production program.

The flow of available supplies was so directed into consuming channels that war production goals set for the year were nearly attained and most of the essential civilian needs were met. Operation of the Controlled Materials Plan is expected to bring about an even closer balance between supply and essential demand.

The industry's and government's success in making such huge tonnage of metal available was the culmination of several programs, including expansion of production facilities, granting of governmental aid to marginal producers, enforcement of economical use of all supplies through conservation orders, and by reducing drastically nonessential use of metals through limitation orders.

Other important supplementary programs designed to augment supplies in-

cluded stimulation of imports under the guidance of the Metals Reserve Co., the substitution of less critical materials for scarce metals and various salvage campaigns. Programs for simplification and standardization and for redistribution of idle stocks were also extremely important. These latter programs will be stressed to an increasing extent during the coming year.

The latest Material Substitution and Supply List, issued by the War Production Board, showed that the following metals are in limited supply, with the relative scarcity indicated on a descending scale by the order of listing: magnesium, aluminum, copper, tin, bronze, brass, cadmium, and zinc.

Although the tightest situations remained in magnesium and aluminum, probably the greatest expansion in production in any comparable period of time has been achieved in those two metals.

Capacity for producing magnesium in this country has been increased spectacularly to over 550,000,000 pounds, equal to about 50 times the amount produced in 1940. This expansion program involved commitments by Defense Plant Corp. alone of over $370,000,000.

Aluminum Facilities Expand

Defense Plant Corp. also has made commitments aggregating nearly $667,200,000 related to the aluminum program, accounting for additional capacity of over 1,200,000,000 pounds, or about three times the total aluminum output of 1940. WPB's original program provided for additional capacity of 850,000,000 pounds and was supplemented by a second program early in 1942 calling for 600,000,000 pounds in added capacity.

These new plants coupled with private industry's expanded facilities will give the United States an aluminum production by the fall of 1943 of 2,400,000,000 pounds, or seven times the size of the peacetime years of 1937, 1938, and 1939. In addition to the output of primary aluminum, production of secondary aluminum ingot will total about 600,000,000 pounds.

Based on official preliminary reports, essential requirements for copper in 1942 were more than 8 per cent in excess of supply while estimated requirements for 1943 are some 25 per cent in excess of maximum visible supply. It is estimated that U. S. supply, including domestic production, scrap and imports jumped to 2,571,700 tons in 1942 compared with only 1,525,500 tons in 1939.

Copper production has been intensified at the 15 large mines which now account for about 98½ per cent of our copper and has been stimulated in the marginal and submarginal mines by payment of a 5-cent per pound premium for "over-quota" production.

Large installations to extract low-grade ores include the project of the Utah Copper Co., which produces 26,000 tons of refined copper a month, and the Morenci open-pit property in Arizona. Altogether the government is spending over $180,000,000 and private industry more than $40,000,000 to develop new copper-producing facilities.

Production of secondary alloy copper-base ingots in 1942 is estimated at 700,000 tons, or nearly twice the volume which had been estimated at the beginning of the year. The large output is attributed to treatment of low-grade scrap which previously had been processed by refineries.

Censorship rules prohibit publication of a comprehensive report regarding expansion of zinc production facilities and no estimate of this phase of the production program has been made by a government official. However, it is well known that many mines have been developed or reopened during the year and that new smelting and refining

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THE CARBURIZER FOR ACID OPEN-HEARTH PRACTICE

• With this Graphite product you can add carbon to your charge with complete confidence of securing over 70% recovery. Free from phosphorus and sulphur, you are assured of a better quality steel. Being the densest carbon obtainable, No. 348 Mexican Graphite takes up a minimum of furnace space. It is especially sized for rapid solution.

If you are working larger scrap heats—with scrap analyses none too stable, you may at least be assured of a specific carbon replacement, and, minus any foaming or gassy reactions. At the same time you will avoid clogged checkers, hot roofs, long heat time and soft heats . . . . the most soluble carbon obtainable . . . . Conveniently packaged, in 100 pound bags.

THE UNITED STATES GRAPHITE CO.
SAGINAW MICH.

NO. 348 MEXICAN GRAPHITE

plants have been constructed. Late in the year, three additional smelter blocks to the Illinois Zinc smelter at Dumas, Tex., came into operation. It was further revealed that production of zinc concentrates is expected to begin in January, 1943, on the Kearney claim in New Mexico and that production of concentrates from the Copper Flat mines will be doubled early in the new year. Illinois Zinc is also doubling its zinc concentrating mill at Deming, N. Mex.

Smelting capacity is now adequate for all the domestic and foreign zinc concentrates available. The big problem in 1943 will be to obtain enough concentrates from mines in this country, Canada and Mexico to safely assure enough material for continuous operations of the smelters. The government has taken several steps to maintain mining of ore at as high a rate as possible, including: the designation of certain western states as a "critical labor area" in which the movement of labor is controlled; the draft deferment of workers in the nonferrous metal mining industry; and the payment of a 2.75-cent per pound premium for "over-quota" production.

The Longhorn tin smelter at Texas City, Tex., soon will have an annual capacity of about 52,000 tons, or sufficient to refine all the tin ore available to the United States.

The situation in lead was unique among the major nonferrous metals in as much as available supplies were relatively large and more than adequate to cover military and essential civilian demands. The large reserve which has been accumulated will probably be drawn upon heavily during 1943, however, in view of the continued uptrend in production of war goods, and the wide substitution of lead for more critical materials.

Developments in 1942 tended to emphasize the fact that salvage of obsolete and idle materials was a necessary adjunct to the primary metals production program. All types and grades of scrap metals were purchased by the Salvage Division of MRC last year from thousands of holders all over the country. These collections of metals were routed either to stockpile, direct to fabricators, to mills for remelting and refining, or to the Army, Navy and Maritime Commission at the proper places for their use.

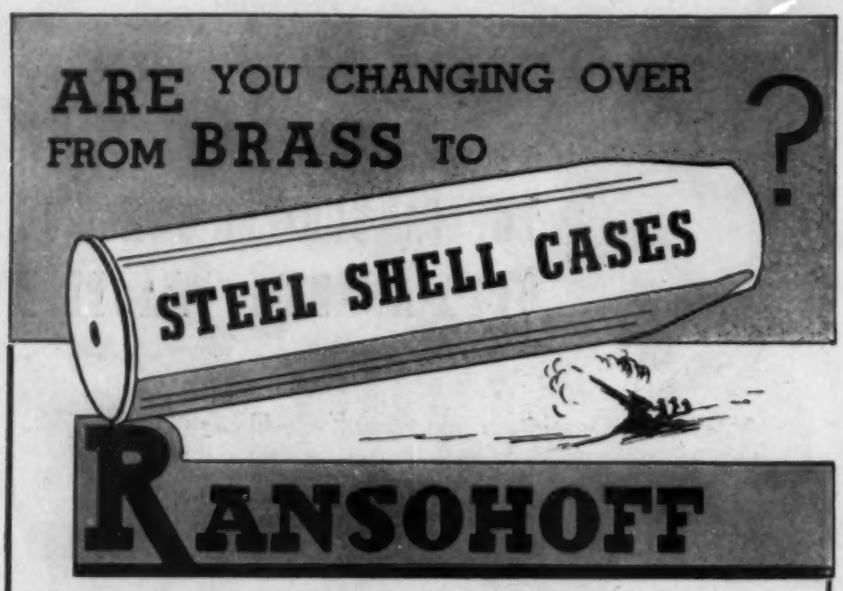
Idle Material Requisitioned

Requisitions of material from unwilling holders, as well as from docks, piers and warehouses containing materials prepared for export to occupied countries, included the following amounts in the first eight months of the plan's operation: 327,000 pounds of copper, 750,000 pounds of aluminum, 194,990 pounds of solder mix, and 90,000 pounds of other metal consisting of pewter, tin case metal, and graphite electrodes.

Copper Recovery Corp., organized to act as agent for MRC in the purchase of approximately 200,000 tons of copper and copper base alloys, representing idle or excessive inventories, has scheduled by allocation over 75,000,000 pounds and over 50,000,000 pounds have been disposed of.

Another program was placed in operation whereby secondary refiners purchase monthly 11,500 tons of copper contained in copper alloy for the production of electrolytic copper.

An unusually stable price situation prevailed throughout the year, reflecting the stringent control exercised by OPA. Prices held at 12.00c, Connecticut, for electrolytic copper; 6.50c, New York, for lead from Jan. 12 compared with 5.85c for the first 11 days of the year; 8.25c, East St. Louis, for prime western zinc; 52.00c, New York, for Straits tin; and 15.00c, delivered, for primary 99 per cent plus aluminum.



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"Easier To Plan in 1943, Due to Better Controls

(*Concluded from Page* 215)

to the main task of winning the war. This trend may be reflected in treatment of the manpower problem, in which are involved such issues as the short work week and "feather-bed practices" of labor, which have sprung up so profusely over recent years. Tax legislation will probably be dealt with more firmly, and with the federal war budget for the next fiscal year scheduled to run possibly as high as $96 billions, compared with the already huge sum of $56 billions for the fiscal year ending next July, there is reason for strong hope that it will be.

There will be checks and investigations into waste and into use of powers already assumed by administrative agencies and into many other things, and while little will probably ever come from a number of them, it does appear that Congress at long last is set to assume a more definite responsibility as to what may transpire in Washington.

With prices pegged on iron and steel products generally throughout the year, sharply increased federal taxes, higher costs and retroactive wage advances cut deeply into steel profits. Third quarter earnings of 14 leading producers were down 41 per cent from the corresponding period in 1941. Earnings for the first nine months totaled $122,448,082, against $202,616,214 in the same period of the previous year. Reflecting the sharp increase in federal income and excess profits taxes, 12 of the producers made provision for $415,478,415 for the first nine months, against $233,364,534.

The renegotiation law has caused many complications for steel companies and when first passed last April was subject to much criticism both as to principle and procedure.

Largest Revenue Act

The largest revenue-raising measure in the history of the country, the Revenue Act of 1942, was passed last October after Congress had worked upon it for well more than six months. There were said, incidentally, to have been 504 differences between the Senate and the House versions, with the House finally yielding on all but 19 of them. The law will yield an estimated $9 billions and is primarily an income tax measure, although it provides for excise tax increases amounting to $500,000,000.

The new excise tax rates became effective Nov. 1 and a Victory tax of 5 per cent on gross income over $12 a week, Jan. 1, with the full impact of the new law on the individual due next March 15, when income tax payments will jump sharply. Exemptions will be lower and rates higher. Normal tax rates on corporations are unchanged, but surtax and excess profits tax rates are up substantially The new law will bring federal revenue up to $25,000,000,000.

While revenue from the law is expected to be the largest ever, receipts will still fall far short of government expenditures. Even before the new law was signed, Secretary Morgenthau had asked for another tax law to provide an additional $6,000,000,000, and as further steps to meet the deficit, announced late in the fall a new program for war borrowing. Under this program frequent offerings of recent months will be eliminated and substituted by larger offerings at less frequent intervals. The first such offering, designed to raise $9,000,000,000, was the largest borrowing operation ever recorded.

Under the new tax law, corporations paying excess profit taxes have the option of taking a post-war refund of 10 per cent of these levies, or use this credit currently to retire debt. Shortly after the passage of the law the United States Steel Corp. announced it was calling $30,000,000 of its debentures.

As the year progressed there was a

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greater delegation of authority by the President. Various administrators, or "czars," were appointed to deal specifically with important phases of the war effort. Today, the President has chiefs in charge of production, prices, manpower, transportation, rubber, petroleum, food and economic stabilization, to cite most of them.

Many overlapping functions have thus been eliminated, yet the appointment of administrators with broad powers to solve their own problems presents difficulties, unless their efforts have overall co-ordination. Hence, it would appear that the establishment of a war council, including these executives and meeting regularly with the President and military heads, is the next logical step in achieving a comprehensive correlation of policy.

Early last year, in January, the Office of Production Management was abolished and WPB established, with Mr. Nelson as chief. The new organization included a number of OPM executives, of which Mr. Nelson was one, with the main differences in its structure being a more centralized authority and an increased emphasis on conversion of civilian production to war work.

Six major divisions—production, purchases, materials, labor, industry operations and civilian supply—were established, and while in general this fundamental pattern prevailed throughout the year, many changes and expansions within the pattern were made in an effort to meet the varying and fast growing needs of the war production program.

Hope Extended to Small Plants Not Making War Goods

WHILE small manufacturers not engaged in war work face the new year with trepidation, they are not without some hope. L. E. Holland, chairman, Smaller War Plants Corp., predicts that shortly thousands of small plants, now idle or operating on a sharply reduced basis, will be working on war contracts.

Likewise, Donald M. Nelson, chairman, War Production Board, holds out encouragement. The proposed aircraft expansion program this year, for instance, will make greater demands on small plants. Too, various large companies have been manufacturing simple parts, which can well be produced by small plants. This WPB is looking into, he says.

Reassuring also was the recent report of General B. B. Somervell before the

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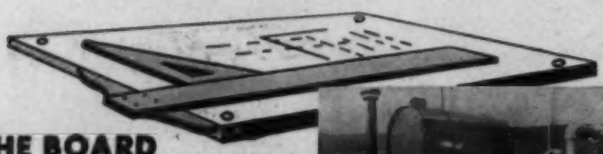
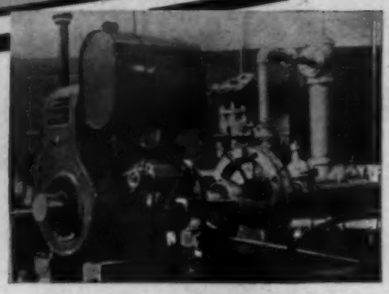


ON THE BOARD
OR ON THE JOB



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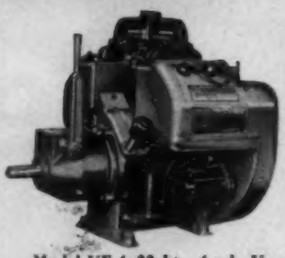

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special Senate Committee on Small Business, to the effect that the War Department is spreading contracts among moderate and small-size companies throughout the country and that during November alone it placed more than $200,000,000 of contracts to companies employing less than 100 persons each.

The orders were not placed haphazardly, he said, but were predicated upon comprehensive surveys of the small plants in various areas. The army was guided in no small measure by the War Manpower Commission's classification of each area on the basis of manpower and housing. "Distressed areas" where civilian unemployment exists are being given special consideration.

Lending force to Mr. Holland's prediction is the fact that his organization now for only the first time has been able to complete its preliminary work and really go ahead. Last May Congress unanimously passed Public Law 603, which led to the creation last summer of the Smaller War Plants division of WPB, with the Smaller War Plants Corp. set up to supervise such expenditures as may be made from the $150,000,000 appropriated to assist small manufacturers, where necessary, in obtaining materials and equipment and in meeting pay rolls to handle war contracts.

Moved Slowly

Having the "toughest assignment in the WPB," however, the new organization has had to move slowly, and, in fact, has only been in administrative existence since last September. One factor for delay was the negotiations which were required to work out agreements with the procurement agencies. Generally these agencies have given SWP enthusiastic support and have agreed to provide it with advance information as to purchasing schedules, so that the small industrialists will have an opportunity to figure before it is too late, as has often been the case over recent months.

The main business of SWP is to get business for the smaller companies and help them with engineering assistance to produce the goods. Companies confronted with immediate suspension are receiving attention first, although efforts also are being made to revive operations at plants which already have been forced to stop work.

At present the division is placing technical representatives in the 127 district offices of WPB to organize local manufacturers and catalogue their facilities, a job that will be aided greatly by what has already been accomplished by previous agencies working in the interests of small manufacturers.

Mr. Holland recently declared that if the small companies can get between 12 and 15 per cent of the war con-

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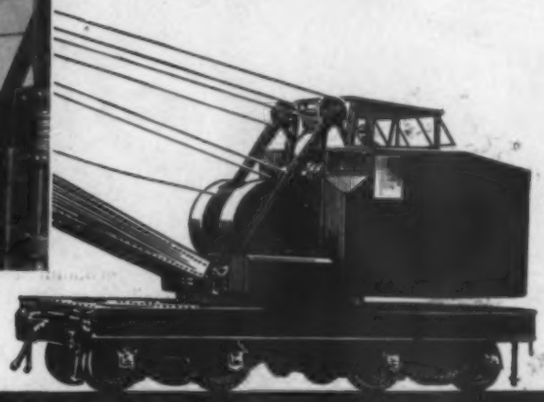

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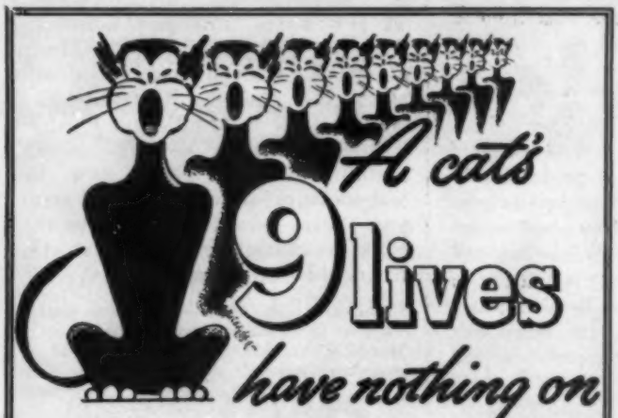

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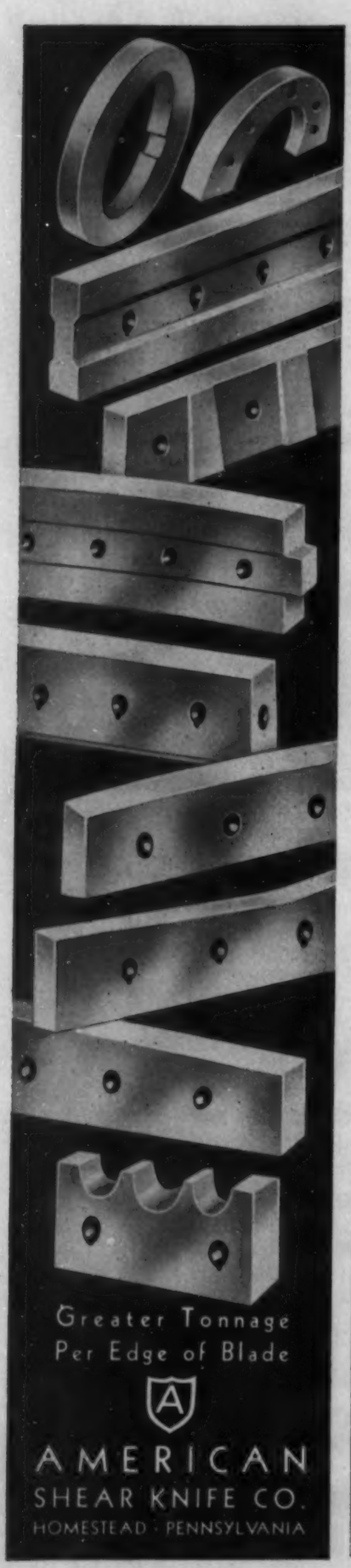

tracts "We can have all of our small plants capable of handling war contracts busy."

However, the enormity of the task confronting SWP may be gathered from the fact that of the 184,000 manufacturing plants in the country, according to the latest census, 169,000 employ fewer than 100 workers each and 72 per cent fewer than 20. Clearly there is not war work or essential civilian work for all, in the light of the present shortage of materials and growing scarcity of manpower, and while the larger companies, although far from all, have the finances and the engineering staffs to adapt themselves to essential work; the smaller companies, as a rule, have not.

Nevertheless, much can be done, it is believed. In England, for instance, small plants employing 50 or less produce 70 per cent of the ammunition, and in Germany the record is said to be still higher. Further, there is growing appreciation that, apart from the war effort itself, sound economic reasons exist for helping small plants, if at all possible, so as to ease the post-war situation.

Concentration of industry is apparently an approved policy of the government, but so difficult and important is the problem of concentration that the government is moving with extreme caution. Thus many small manufacturers (to say nothing of a number of the larger ones) are keeping their fingers crossed until they can see what is going to happen.

More Concentration in Sight

The program as now being worked out will be directed by the WPB office of civilian supply, the labor production division and the office of the director general for operations. Many small manufacturers of non-war goods fear they will no longer be permitted to operate, even though materials may not be scarce; they fear general stringency in manpower, electric power and transportation will force them down.

British experience in industrial concentration will probably be drawn upon to a considerable extent, it is believed. According to a recent tabulation, 46 British industries have been concentrated, with many small plants suffering but others benefiting. Some business and industrial leaders here believe that the principle of concentration of industries producing civilian goods should be adopted by the government only as a measure of last resort.

Some experimenting, though, has already gotten under way—notably in stoves, bicycles, typewriters and farm implements, with dollar volume and location the two factors in the selection of plants for concentration. Thus, in

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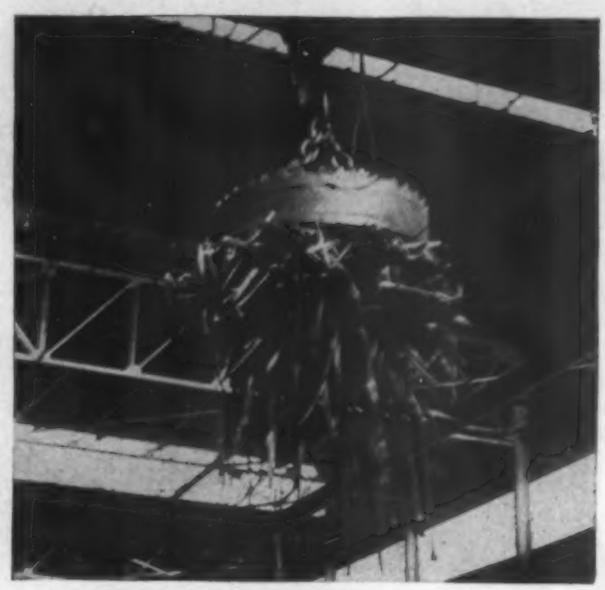

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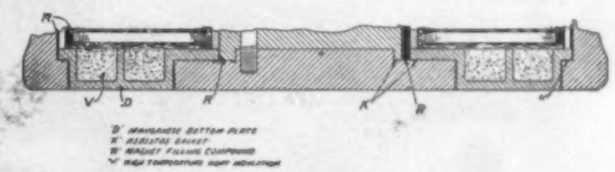

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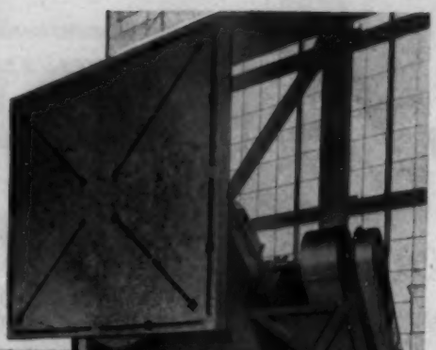

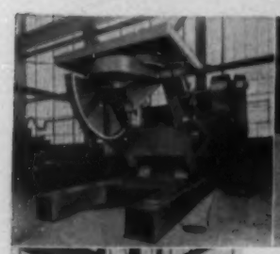

Note extra floor and working clearance obtained by tilting "boom" also how table can be tilted to degrees impossible with vertical or upright table support

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but can be tilted almost completely over thru an arc of 135°, *or to 45° beyond vertical*—permitting down-hand welding not only of all sides and top of the weldment but of the "bottoms" too, with a single set-up.

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the stove industry all plants with an annual volume of more than $2,000,000 were to convert to war work; those doing less but located in districts where labor was scarce likewise were to convert to war work, while those doing less but operating where labor was plentiful were permitted to produce light, stripped stoves. Results of this experimenting to date, however, have not been impressive, with various problems involving trademarks, pricing, market zoning and so forth, still to be ironed out.

Small manufacturers are also weighing the probable effects of the Controlled Materials Plan. Here they will run into a vertical allocation of materials, instead of a horizontal distribution, and for many under the new plan much will depend upon their good fortune in getting lined up with prime contractors who, under CMP, exercise the vertical control, once contracts are approved; in other words, each prime contractor will be allocated the necessary materials for his contract, corvering not only needs of his own, but those of his subcontractors and their suppliers.

At present a special Senate committee is analyzing the relationship of CMP to the small manufacturers, this as one of various phases of an investigation which Senator Murray, chairman, hopes will get to "the very bottom of the small business problem."

Manpower-Labor Problem Critical

(*Concluded from Page* 221)

ate a widespread demand for increased wages, throw the entire wage structure out of adjustment and remove an important incentive for labor to shift from nonessential industries into war production jobs. This view was also endorsed in part by some industrial leaders.

While his charge brought denial in administration circles, Senator Byrd, of Virginia, recently charged that the federal government "is the chief offender of waste and hoarding manpower." He estimated that by the first of this year the federal government would have 3,000,000 civilian employes and state and local government an additional 2,500,000. Thus, he declared, there are more government employes than there are soldiers, sailors and marines.

Much emphasis is being placed on training within industry and on special courses in schools and colleges. At many plants automatic age retirement programs have been suspended.

An important forward step toward a systematic solution of essential industries manpower problems is the so-called manning table plan, drawn up jointly by

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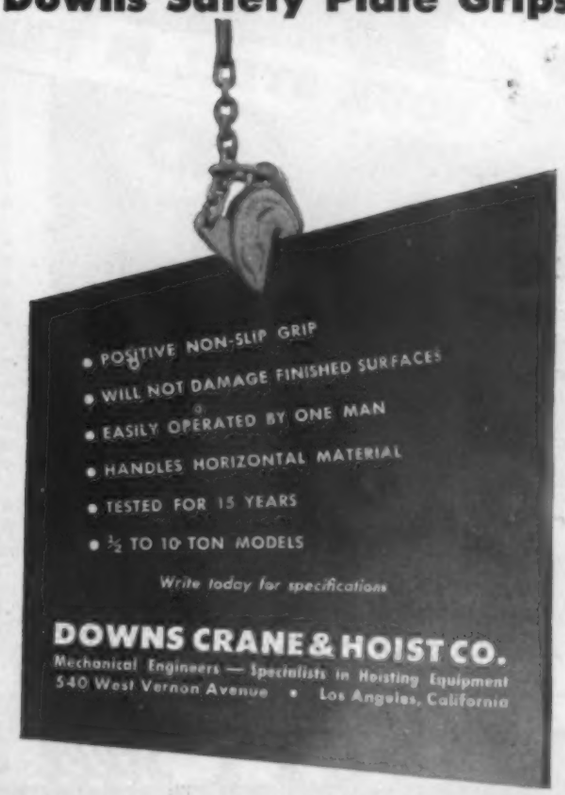
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As previously indicated, women are being employed in increasing numbers. The steel industry has not gone far in the employment of women in its plants to date (although possibilities are being fully explored), but large numbers are being employed in the aircraft and light ordnance and metalworking industries.

According to the United States Department of Labor there were 117,931 women in the aircraft plants in October, comprising 104,662 in air frame production, 11,663 in engine production and 1606 in propeller production. Since then, it is believed that the number engaged in this industry has increased sharply.

In October, according to the department, about 100,000 were engaged in production of "iron and steel products," excluding primary iron and steel products and machinery. Commercial shipyards were then employing 13,600 women workers.

Accompanying this article, on page 220, is a table covering preliminary estimates on labor, as applied to both women and men until the end of this year.

"Maintenance of Membership" Becomes Government Policy

Out of the welter of confusion that has marked the government's labor policy for months one thing by now appears definitely clear; and that is that "union maintenance," the all but twin brother of the closed shop, has been set up at least for the duration. The Little Steel companies accepted it under pressure last summer, to be followed shortly by Big Steel, which only the year before had been forced to accept it on behalf of its subsidiary, the Federal Shipbuilding & Dry Dock Co., Kearny, N. J. But the final clincher came toward the close of the year, when Montgomery Ward Co., a non-war enterprise, in a direct communication to the President, questioned the authority of the National War Labor Board to impose such a condition. The President, as commander-in-chief of the Army and Navy, ordered the company "to comply without further delay."

Union maintenance technically does fall short of the closed shop, for under this proviso a worker may theoretically

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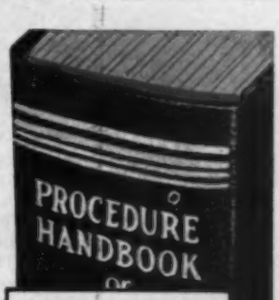

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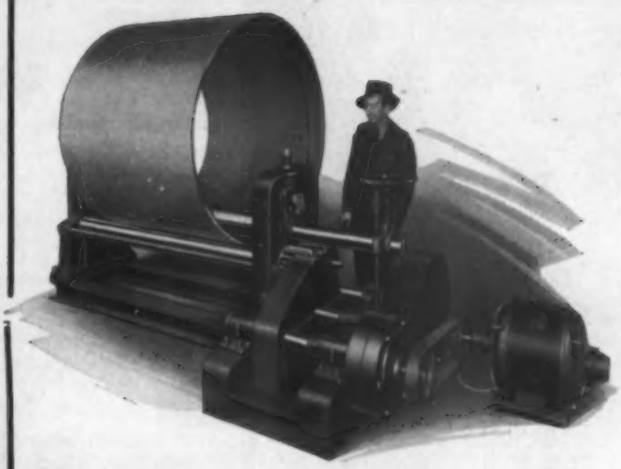

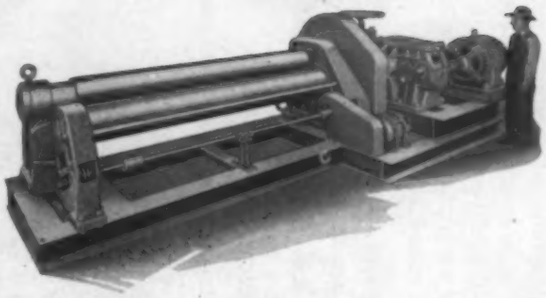

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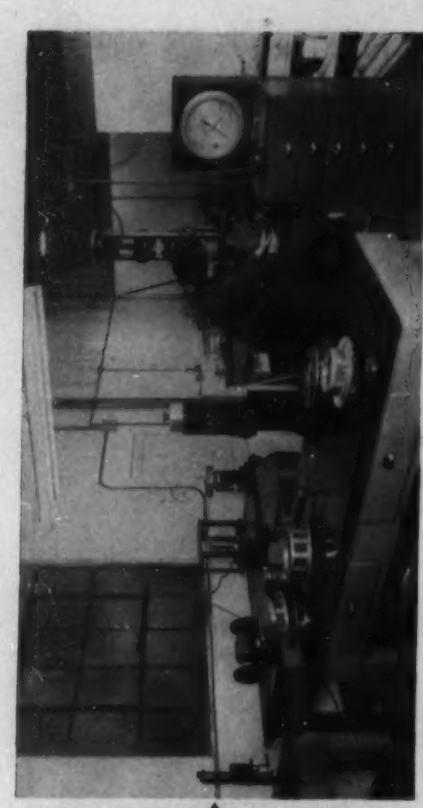

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elect to remain unionized, whereas the essence of the closed shop is that all workers must be union members. However, once a worker under union maintenance does become a union member (and only the very hardiest can resist the force that is brought upon him by the union workers to become a member), he holds his job during the term of contract only by virtue of his membership. If he resigns that membership or is expelled from the union, the employer is bound to discharge him—and all this in a period of war.

It is a principle that most employers believe has gone far beyond even the plain directions of the Wagner act and a principle that has been imposed through compulsion by the NWLB, which unlike the National Labor Relations Board, has no statutory standing whatsoever.

Many contend that if the NWLB is to continue to enforce compulsory arbitration of labor disputes it should have statutory standing, under clear authorization of Congress, and should be composed wholly of representatives of the public.

Strikes Less Numerous

While far less numerous than last year, and this is particularly true of the steel industry itself, labor strikes and slowdowns continued to handicap the country in its first full year of the war. The peak, it appears, was reached during the summer. In July strikes beginning in that month totaled 400, the highest up to that time, then dropped to 350 in August and 290 in September, which latter compared with 470 in September, 1941. However, the actual number of days lost and the number of workers involved in September were the same as in August, as the strikes were longer and each involved a greater number of employes.

Records for the first nine months reveal a total of 2560 strikes, against 4228 for all of 1941, thus virtually assuring a substantial decline for 1942. Of these 2560 strikes, 1086 were in war industries, according to a compilation of the National Industrial Conference Board, and as in the case of the overall figures, the peak from the standpoint of new disturbances, was reached in July, 198. However, from the standpoint of total strikes in progress the top was attained in August, amounting to 229, against 222 in July, and from that of idle man-days, the most significant figure of all, the peak was reached in September, 319,000.

The idle man-day record, interestingly, increased in each succeeding month, except in July, when there was a decline, which was well more than offset in August. The total loss in idle man-

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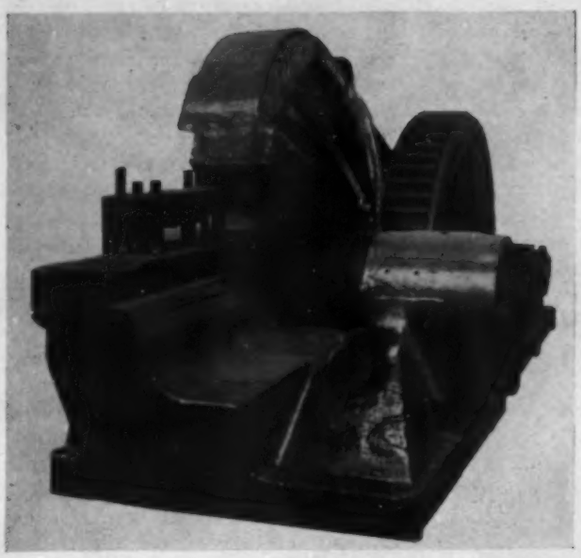

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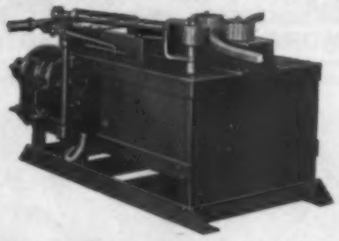

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days from strikes during the first nine months in the war industries was 1,720,000. What this meant indirectly through disturbed schedules in other plants as a result of delays in materials and equipment cannot be calculated. Another bugbear was absenteeism, and steel got its full share of that.

During the late spring and summer months antistrike agitation reached a new high. Many congressmen were deluged with protests; the press was almost universal in its condemnation; strong letters came in from many in the armed services; and various men in public life—some speaking off the record because of their official position—had plenty to say. But as usual over recent years in all matters pertaining to legislation placing any restriction on labor, nothing came of it in Washington.

In an especially prepared analysis, National Association of Manufacturers charged that in July strikes cost the country 1,868,912 manhours, and typical of the defense set up was the retort by Chairman Davis, of NWLB, to the effect that strikes in that month affected only eight one-hundredths of the nation's labor force. Although, he added, there had been an increase in the numbers of men involved in strikes—from 11,605 in January to 80,722 in July—it was not alarming.

And while he was making his statement, as it so happened, a dispatch appeared in the press from South Chicago, Ill., to the effect that 81 workers engaged in a jurisdictional strike for six weeks had delayed for four months completion of a $60,000,000 mill which add 750,000 tons of steel capacity to the country's war production. The National Association pointed to this as its answer.

Needless to say, public clamor, participated in by the great majority of workers themselves, did lead eventually to restraint over closing months, although still leaving much to be desired.

Contributing much to labor unrest over the past year was a lack of basic policy from the start. When National War Labor Board took over early in the year after its predecessor, the National Defense Mediation Board, finally had become wrecked on the issue of union security, the new organization likewise immediately began the policy of settling each case on its own merits.

No Fixed Policy

There was no attempt to freeze basic relations between management and labor, as was the case during the first World War, and disputes over jurisdictional matter and union maintenance, if not the closed shop itself, and with demands generally accompanied by requests for higher wages, continued to give rise to strikes. If broad basic policies had been set up at the start many such disputes, it is claimed, would never have developed.

Almost without fail wage increases were granted. President Roosevelt, in his speech of April 27, declared that "wages in general can and should be kept at existing scales." But in case after case after that NWLB continued to grant increases, and then in July, with the cost of living mounting steadily, granted still another increase, but for the first time laid down a broad standard—at least a standard of sorts.

This was in the well-known Little Steel case. The men had asked (in addition to union maintenance and the check-off, which they got) for a dollar a day increase, but were granted an additional 44 cents a day. NWLB declared this would bring the purchasing power of the workers involved back to what it was on Jan. 1, 1941, and added that this would be its stabilization policy.

This, of course was immediately inflationary in itself. It affected eventually almost every wage earner in the steel industry and most salaried workers as well, with increases retroactive to Febru-

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ary, and led to broad advances in the automobile industry, whose case was then pending, and to increases in many others. Then, too, there were the vaguely defined elevator clauses about eliminating "sub-standard wages and inequalities of wages," which left question as to how rigid the stabilization policy might prove to be.

Meanwhile, the President had become so concerned over the trend in living costs that in his Labor Day speech he set an Oct. 1 deadline for Congressional action on farm prices, which he regarded as most critical, and promised he would follow up with an executive order on wages. After much sharp debate not only on farm prices and wages, but executive and legislative powers, and chafing under a situation for which it felt it was not wholly responsible, Congress passed an anti-inflation measure more or less in the form the President desired on Oct. 2.

In a sweeping order to implement the new law, the President then promptly directed NWLB to limit wages and salaries, the Office of Price Administration to fix ceilings on retail and wholesale prices and rents not yet curbed, and the Department of Agriculture and the OPA to co-operate in holding down farm prices. He set up the Office of Economic Stabilization with James F. Byrnes resigning from the Supreme court to assume charge as director of economic stabilization. Subsequently, Director Byrnes was to issue the order limiting salaries to $25,000 after federal taxes and certain other obligations have been met. Its implications, rather than effect, were regarded by many as far reaching. Congress had at least twice refused to take such action, and apparently is not through with the issue yet.

NWLB under the new order, was instructed not to approve any increases in the wage rates prevailing on Sept. 15, 1942, "unless necessary to correct maladjustments or inequalities, or to eliminate sub-standards of living, to correct gross inequities or to aid in the prosecution of the war." These exemptions raised questions as to the effectiveness of the control, but the latest statement of policy by NWLB reflects a firmer stand against wage increases than it has taken previously.

Policy Defined

"Maladjustment" will not apply to workers who have received a 15 per cent increase in wages since Jan. 1, it is now ruled. Moreover, where wage differentials have existed for some time the board claims it will not rule that inequalities exist; nor will it approve wage increases for the purpose of influencing or directing the flow of manpower, it is declared.

However, the firmer position taken by NWLB will not, it is pointed out, check the expansion in total wage payments Continued rise in employement and lengthening in working hours, with the extra pay for time beyond 40 hours a week contribute much more to an increase in payments than advances in individual wage rates. In fact, OPA in a recent study, covering the period from Jan. 1, 1941, to May 1, 1942, finds that basic wage rates are one of four contributing factors and not the most important. Out of a rise of $17.8 billions in wages and salaries in that period, advances in base rates accounted for only $4.6 billions, or 26 per cent; increased employment, $5.9 billions, or 33 per cent; increased number of hours worked, $3.9 billions, or 22 per cent; and the shifting of workers to higher pay classifications, $3.4 billions, or 19 per cent.

Under direction of Mr. Byrnes, NWLB passes upon pay rises for workers earning less than $3000 a year and for those earning less than $5000, where compensations are fixed by collective bargaining. The Treasury Department passes upon all compensations above $3000 which are not regulated by NWLB.

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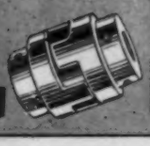

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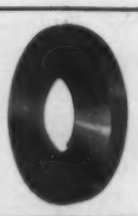

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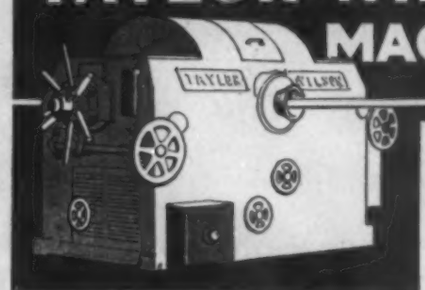

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Rush Expansions, Batcheller Urges

CONTINUED and unslackened efforts must be made by the steel industry to meet 1943 production goals, Hiland G. Batcheller, director of WPB's Steel Division said last week.

Pointing to Chairman Nelson's recent report on the status of the expansion program, Mr. Batcheller warned that the peak capacity of 97,115,000 tons of steel ingots will be achieved on schedule only if management and labor, from the mines through the mills, work unceasingly to finish each part of the program on schedule, and if possible, ahead of schedule.

"The steel industry has just passed through a year in which vast demands were made of it. By and large, it met those demands with a production of 86,000,000 tons of ingots. And at the end of the year, the industry was operating at an annual rate of 89,000,000 tons," Mr. Batchellor stated.

"The Steel Division has promised the War Production Board that it will 'deliver' even more steel next year. The fulfillment of that promise is dependent on every member of the steel industry itself.

"If ore production is going to hit the annual rate of 134,000,000 tons next year; if our open hearths are going to produce at the annual rate of 84,000,000 tons; if we are going to reach a peak of 6,000,000 tons of electric furnace capacity—if we are going to meet all our goals, each individual working on any part of the huge expansion program must do his bit to get it finished— and finished quickly.

"And of course, the sooner we finish the expansion job, the quicker we'll beat the Axis. For so far, this has been a war of steel—steel for us and our Allies—steel for tanks, for guns, for planes, and a multitude of other things."

Mr. Batcheller pointed out that 1943 is the key year as far as the steel expansion program is concerned.

"Most of the groundwork was laid in 1942, and a good part of the additional facilities were brought in," Mr. Batcheller said.

"However, the larger part of the new facilities is scheduled to be brought in operation in the first six months of this year.

"The amount of ingot capacity which will be added during the next six months exceeds the total production which the Japs can muster. Let's think of that, and not waste a day in finishing up the job."

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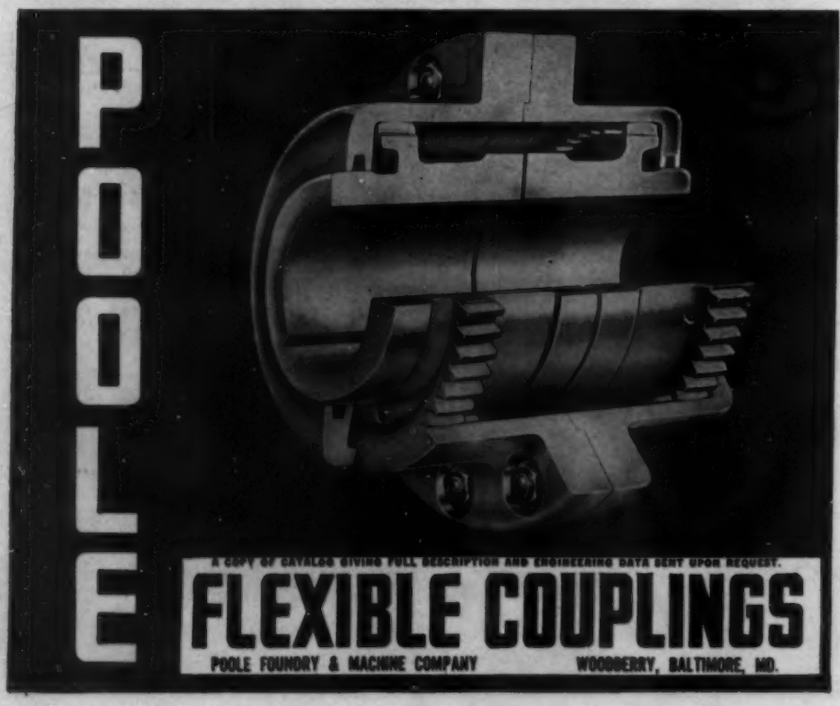
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Sheetworking Equipment Demand at Peak in 1942

Demand for sheet metalworking equipment of all kinds in 1942 topped all previous records. The year started with bulging order books and in March big backlogs started to build up. At the end of the year deliveries named averaged around six to seven months, with production at full capacity assured within that period.

Greatest urgency for such equipment came from the aircraft industry with shipbuilding in second place. In addition there was a lot of miscellaneous demand. In the last few weeks of 1942 new demand had fallen off substantially but there were indications that additional large orders might be in the offing, particularly in connection with the aircraft production program.

First American Red Cross First Aid detachment to be organized in an industrial plant under the auspices of the Passaic, N. J. Red Cross has been formed at Manhattan Rubber Mfg. Division of Raybestos-Manhattan Inc.

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CONSTRUCTION AND ENTERPRISE

OHIO

CLEVELAND—Gray Tool & Die Co., 1861 West Forty-seventh street, is extending office space with a new addition to building.

CLEVELAND — Mayfran Engineering Co., 1710 Clarkstone road, has received authorization of a contract to equip an Ohio war plant.

CLEVELAND—Glenn Tool Co., operated by Christopher and Jack Schron, is putting up a $17,000 addition to its shop building at 716 East 163rd street. Headquarters are at 878 East 152nd street.

CLEVELAND—East Shore Machine Products Co., Nellie M. Gottschalt, president and treasurer, will start work early this month on an addition to factory at 835 East 140th street.

ELYRIA, O.—Pfaudler Co. is enlarging Elyria division plant on Taylor street. A one-story addition will house 1400 square feet of office space and another addition of 9600 square feet will be used for additional factory space.

MARYLAND

BALTIMORE—Maryland Sanitary Mfg. Corp. is altering and expanding its plant at cost of approximately $1,250,000.

BALTIMORE—Bartlett Hayward Division of Koppers Co., 200 Scott street, will start work soon on three-story service building. American Hammered Piston Ring Division of this company, Bush and Hamburg streets, has awarded contracts for warehouse extension and an addition to service building.

BALTIMORE—Westinghouse Electric & Mfg. Co. will soon erect addition to service building at 4015 Foster avenue.

BALTIMORE—Eastern Rolling Mill Co. is erecting small addition to its laboratory building.

BALTIMORE—Air Reduction Sales Corp., New York, will operate an oxygen plant to be built by Defense Plant Corp. at 1700 Chesapeake avenue, Fairfield.

BALTIMORE—Maryland Dry Dock Co. has awarded contract for a dock control house at its Fairfield plant.

CANADA

MALTON, ONT.—Victory Aircraft Ltd., N. Wagner, chief engineer, has given general contract to Milne & Nicholls Ltd., 57 Bloor street West, Toronto, for electroplating plant. Cost with equipment about $35,000.

OAKVILLE, ONT.—Edmanson Bates & Co. Ltd., Colborne street West, has plans by Molesworth & Secord, architects, 18 Toronto street, Toronto, for plant extension. Building is to be occupied by Air Coils Ltd.

RENFREW, ONT.—Renfrew Electric & Refrigerator Co. Ltd., Hall street, has given general contract to M. J. Sulphur & Son, Lisgar street, and a number of subtrades have been let in connection with repairs to plant and installation of woodworking equipment, to cost about $20,000. N. M. Moffatt, 89 Argyle street, architect.

TORONTO, ONT.—Atlas Engineering & Machine Co. Ltd., 14 Eastern avenue, has given general contract to Chestnut-McGregor Ltd., 96 Bloor street, West, for plant addition estimated to cost $20,000.

TORONTO, ONT.—Canadian Rogers Sheet Metal & Roofing Ltd., 918 Palmerston boulevard, is proceeding with work on welding shop addition to cost about $10,000. E. S. Martin, 16 Saulter street, has general contract and subtrades have been let.

WINDSOR, ONT.—Ford Motor Co. of Canada Ltd., Sandwich street, East, has advanced closing date for receiving bids for proposed $180,000 plant substation and equipment and also for other plant addition to cost $65,000.

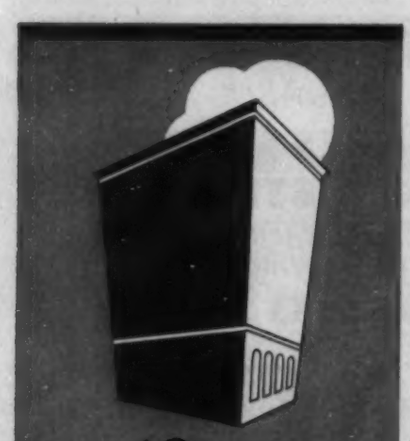
CAP DE LA MADELINE, QUE.—Aluminum Co. of Canada Ltd., 1010 St. Catharine street West, Montreal, is considering plans for plant addition here to cost about $1,000,000.

BEAUHARNOIS, QUE.—Aluminum Co. of Canada Ltd., 1010 St. Catharine street, West, Montreal, has awarded number of subtrades in connection with aluminum plant here to cost about $4,000,000, with equipment. Anglin Norcross Ltd., 892 Sherbrooke street West, Montreal, has general contract.

LAUZON, QUE.—George T. Davie & Sons, 27 Davie street, are starting work on erection of further plant addition here estimated to cost about $35,000.

LONGUEUIL, QUE.—Dominion Engineering Works, First avenue, Lachine, plans to start work early in 1943 on miscellaneous plant additions to its works here, estimated to cost, with equipment, about $100,000.

MONTMORENCY, QUE.—Quebec Railway, Light & Power Co., 229 St. Joseph street, Quebec City, plans addition to substation here to cost about $20,000. New equipment installations include 500-kilowatt rotary converter with auxiliary equipment, and three 200-kva. 40-cycle transformers.



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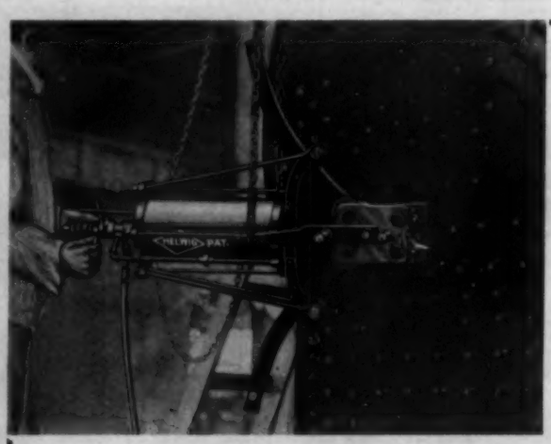

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SECTION TWO
JANUARY 4, 1943
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ABRASIVE WHEELS

Abrasive Co., Tacony & Fraley Sts., Philadelphia, Pa.
Atkins, E. C., & Co., 427 So. Illinois St., Indianapolis, Ind.
Bay State Abrasive Products Co., Westboro, Mass.
Blanchard Machine Co., The, 64 State St., Cambridge, Mass.
Carborundum Co., The, Niagara Falls, N. Y.
Chicago Wheel and Mfg. Co., Dept. ST, 1101 W. Monroe St., Chicago, Ill.
DeSanno, A. P., & Sons, Inc., 436 Wheatland St., Phoenixville, Pa.
Macklin Co., Jackson, Mich.
Norton Co., Worcester, Mass.
Sterling Grinding Wheel Div. Cleveland Quarries Co., Tiffin, O.

ABRASIVES (Blast Cleaning)

Alloy Metal Abrasive Co., 311 W. Huron St., Ann Arbor, Mich.
American Foundry Equipment Co., The, 509 S. Byrkit St., Mishawaka, Ind.
Carborundum Co., The, Niagara Falls, N. Y.
Pangborn Corp., Hagerstown, Md.
Pittsburgh Crushed Steel Co., 4839 Harrison St., Pittsburgh, Pa.
Vapor Blast Mfg. Co., 333 S. 16th St., Milwaukee, Wis.

ABRASIVES (Coated Paper & Cloth)

Abrasive Products Inc., S. Braintree, Mass.
Carborundum Co., The, Niagara Falls, N. Y.
Minnesota Mining & Mfg. Co., 900 Fauquier St., St. Paul, Minn.

ABRASIVES (Polishing)

Abrasive Co., Tacony & Fraley Sts., Philadelphia, Pa.
Carborundum Co., The, Niagara Falls, N. Y.
Chicago Wheel & Manufacturing Co., Dept. ST, 1101 W. Monroe St., Chicago, Ill.
General Abrasive Co., College Ave., & Hyde Park Blvd., Niagara Falls, N. Y.
Norton Co., Worcester, Mass.

ACCUMULATORS

Aldrich Pump Co., 2 Gordon St., Allentown, Pa.
Babcock & Wilcox Co., The, 85 Liberty St., New York City.
Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia, Pa.
Elmes, Chas. F., Engineering Wks., 243 N. Morgan St., Chicago, Ill.
Farquhar, A. B., Co., Ltd., 195 Duke St., York, Pa.
Hydropress, Inc., 570 Lexington Ave., New York City.
Logemann Brothers Co., 3126 Burleigh St., Milwaukee, Wis.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Morgan Engineering Co., The, Alliance, O.
Schloemann Engineering Corp., Empire Bldg., Pittsburgh, Pa.
Taylor-Wilson Mfg. Co., 15 Thomson Ave., McKees Rocks, Pa.
Watson-Stillman Co., Roselle, N. J.
Wood, R. D., Co., 400 Chestnut St., Philadelphia, Pa.

ACETYLENE

Air Reduction, 60 E. 42nd St., New York City.
Linde Air Products Co., The, 30 E. 42nd St., New York City.
National Cylinder Gas Co., 205 W. Wacker Dr., Chicago, Ill.

ACID-PROOF LININGS

Ceilcote Co., 750 Rockefeller Bldg., Cleveland, O.
Harbison-Walker Refractories Co., Farmers Bank Bldg., Pittsburgh, Pa.
National Carbon Co., W. 117th St. & Madison Ave., Cleveland, O.
National Lead Co., 111 Broadway, New York City
Pennsylvania Salt Mfg. Co., Widener Bldg., Philadelphia, Pa.

ACIDS (Pickling)

American Chemical Paint Co., Dept. 310, Ambler, Pa.
Pennsylvania Salt Mfg. Co., Widener Bldg., Philadelphia, Pa.

ADHESIVES

Avery Adhesives, 451 E. 3rd St., Los Angeles, Cal.

AEROCASING

Lakeside Steel Improvement Co., The, 5418 Lakeside Ave., Cleveland, O.

AIR COMRESSORS—See COMPRESSORS (Air)

AIR CONDITIONING EQUIPMENT

American Air Filter Co., 443 Central Ave., Louisville, Ky.
Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.
General Electric Co. (Air Conditioning & Commercial Refrigeration Dept., Div. 431,) Bloomfield, N. J.
Graybar Electric Co., 420 Lexington Ave., New York City
Lintern Corp., The, Lincoln Ave., Berea, O.
Salem Engineering Co., Air Conditioning and Refrigeration Div., 714 S. Broadway, Salem, O.
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.
Weatherhead Co., The, 300 E. 131st St., Cleveland, O.
Westinghouse Electric & Mfg. Co., 653 Page Blvd., Springfield, Mass.
Worthington Pump & Machinery Corp., Harrison, N. J.

AIRCRAFT ACCESSORIES, PARTS, SUPPLIES

Andrews Steel Co., The, Newport, Ky.
Doyle, The, J. E., Co., 1220 West 6th St., Cleveland, O.
Elastic Stop Nut Corp., 2340A Vauxhall Rd., Union, N. J.
Fidelity Machine Company, 3908 Frankford Ave., Philadelphia, Pa.
Garrett, George K., Co., D & Tioga Sts., Philadelphia, Pa.
General Electric Co., Bridgeport, Conn.
Kropp Forge Co., 5301 W. Roosevelt Rd., Chicago, Ill.
Spriesch Tool & Mfg. Co., 10 Howard St., Buffalo, N. Y.
Steel and Tubes Div. Republic Steel Corp., 224 E. 131st St., Cleveland, O.
Weatherhead Co., The, 300 E. 131st St., Cleveland, O.

AIRLESS BLAST CLEANING EQUIPMENT

American Foundry Equipment Co., The, 509 S. Byrkit St., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.
Vapor Blast Mfg. Co., 333 S. 16th St., Milwaukee, Wis.

ALARM SYSTEMS (Automatic)

Automatic Alarms, Inc., 830 Market St., Youngstown, O.

ALKALI CLEANING COMPOUNDS

American Chemical Paint Co., Ambler, Pa.
Detroit Rex Products Co., 18029 Hillview Ave., Detroit, Mich.
Pennsylvania Salt Mfg. Co., Dept. S, Pennsalt Cleaner Div., Philadelphia, Pa.

ALLOY METALS (See Specific Metals)

ALLOY METALS (Nonferrous)

American Brass Co., The, Waterbury, Conn.
Ampco Metal, Inc., Dept. S-1, 3830 W. Burnham St., Milwaukee, Wis.
Bristol Brass Corp., The, Bristol, Conn.
Cadman, A. W. Mfg. Co., 2816 Smallman St., Pittsburgh, Pa.
Copperweld Steel Co., Glassport, Pa.
Dow Chemical Co., The, Midland, Mich.
Harper, The, H. M., Co., 2646 Fletcher St., Chicago, Ill.
Revere Copper & Brass Co., Inc., 230 Park Ave., New York City
Shenango-Penn Mold Co., 407 W. Third St., Dover, O.

ALLOY STEELS (Corrosion & Abrasive Resistant)

Carnegie-Illinois Steel Corp., 327 Carnegie Bldg., Pittsburgh, Pa.
Carpenter Steel Co., Reading, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
International Nickel Co., Inc., The, 67 Wall St., New York City
Michiana Products Corp., Michigan City, Ind.
Midvale Co., The, Nicetown, Philadelphia, Pa.
Wall-Colmonoy Corp., 720 Fisher Bldg., Detroit, Mich.

ALLOY STEELS (Heat Resistant)

Carnegie-Illinois Steel Corp., 327 Carnegie Bldg., Pittsburgh, Pa.
Carpenter Steel Co., Reading, Pa.
International Nickel Co., Inc., The, 67 Wall St., New York City
Michiana Products Corp., Michigan City, Ind.
Midvale Co., The, Nicetown, Philadelphia, Pa.

ALLOYS (Aluminum, Brass, Bronze Copper, Phosphor Bronze)

National Bearing Metals Corp., 4930 Manchester Ave., St. Louis, Mo.

ALLOYS (Corrosion and Abrasive Resistant)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh, Pa.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

ALLOYS (Ferroalloys)—See FERROALLOYS

ALLOYS (Magnesium)

Dow Chemical Co., The, Midland, Mich.

ALLOYS (Nonferrous)

Mallory & Co., P. R., 3029 E. Washington Ave., Indianapolis, Ind.

ALLOYS (Nickel)

International Nickel Co., Inc., The, 67 Wall St., New York City

ALUMINUM (Screw Stock)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh, Pa.

ALUMINUM AND ALUMINUM ALLOYS

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh, Pa.

ANGLES—See BEAMS, CHANNELS, ANGLES

ANNEALING (Tempering)

Lakeside Steel Improvement Co., The, 5418 Lakeside Ave., Cleveland, O.
Lepel High Frequency Laboratories, Inc., 39 W. 60th St., New York City

ANNEALING BOXES

Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Continental Roll & Steel Fdry. Co E. Chicago, Ind.
General American Transportation Corp., 135 S. LaSalle St., Chicago, Ill.
Mesta Machine Co., P. O., Box 1466, Pittsburgh, Pa.
National-Erie Corp., Erie, Pa.
Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.
Union Steel Casting Div. of Blaw-Knox Co., 62nd & Butler Sts., Pittsburgh, Pa.
United Engineering & Foundry Co., First National Bank Bldg., Pittsburgh, Pa.
Wilson, Lee, Engineering Co., 20005 Lake Rd., Cleveland, O.

ANNEALING COVERS

Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh, Pa.
Salem Engineering Co., 714 S. Broadway, Salem, O.

ANODES (All Types)

Revere Copper & Brass Co., Inc., 230 Park Ave., New York City
Udylite Corp., The, 1651 E. Grand Blvd., Detroit, Mich.

ANODES (Lead & Lead Alloy)

National Lead Co., 111 Broadway, New York City

ANODES (Nickel)

Seymour Manufacturing Co., The, Seymour, Conn.
Udylite Corp., The, 1651 E. Grand Blvd., Detroit, Mich.

ANVILS

Swedish-American Steel Corp., 430 Kent Ave., Brooklyn, N. Y.

AXLES

Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Lempco Products Inc., Dept. SS, Bedford, O.
Republic Steel Corp., Dept. ST, Cleveland, O.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.

BABBITT METAL

Cadman, A. W., Mfg. Co., 2816 Smallman St., Pittsburgh, Pa.
National Bearing Metals Corp., 4930 Manchester Ave., St. Louis, Mo.
National Lead Co., 111 Broadway, New York City
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.

BADGES AND BUTTONS

St. Louis Button Co., 413-415 Lucas Ave., St. Louis, Mo.

BALANCING MACHINES

Gisholt Machine Co., 1217 E. Washington Ave., Madison, Wis.

BALING PRESSES—See PRESSES (Scrap Bundling & Baling)

BALL TRANSFERS

Mathews Conveyer Co., 142 Tenth St., Ellwood City, Pa.

BALLS (Brass or Bronze)

Atlas Ball Div. SKF Industries, Inc., Philadelphia, Pa.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.
Strom Steel Ball Co., 1850 S. 54th Ave., Cicero, Ill.

BALLS (Special Alloy Metals)

Atlas Ball Div. SKF Industries, Inc., Philadelphia, Pa.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.

BALLS (Steel) (*Also Stainless)

*Atlas Ball Div. SKF Industries, Inc., Philadelphia, Pa.
*SKF Industries Inc., Front St. & Erie Ave., Philadelphia, Pa.
*Strom Steel Ball Co., 1850 S. 54th Ave., Cicero, Ill.

BAND FILES (Metal)

Continental Machines, Inc., 1324 S. Washington Ave., Minneapolis, Minn.

BAND SAWS (Metal Cutting)—See SAWS (Band—Metal Cutting)

BANDS AND HOOPS (Iron and Steel)

American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.

BANDS AND HOOPS (Iron and Steel)—Con.

Stanley Works, The,
New Britain, Conn.
Bridgeport, Conn.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Youngstown Sheet & Tube Co., The, Youngstown, O.

BAR BENDERS

Kardong Bros. Inc., 346 Buchanan St., Minneapolis, Minn.

BARGE MOVERS

Silent Hoist Winch & Crane Co., 849 63rd St., Brooklyn, N. Y.

BARGES (Steel)

American Bridge Co.,
Frick Bldg., Pittsburgh, Pa.
Bethlehem Steel Co.,
Bethlehem, Pa.
Dravo Corp. (Engin'r'g Works Div.)
Neville Island, Pittsburgh, Pa.
Federal Shipbuilding & Dry Dock Co., Kearny, N. J.
Jones & Laughlin Steel Corp.,
Jones & Laughlin Bldg.,
Pittsburgh, Pa.
Maryland Dry Dock Co.,
Baltimore, Md.

BARGES (Wood)

Koppers Co., Wood Preserving Div., 300 Koppers Bldg., Pittsburgh, Pa.

BARREL DUMPERS

Economy Engineering Co.,
2657 W. Van Buren St.,
Chicago, Ill.

BARRELS (Plating)

Udylite Corp., The, 1651 E. Grand Blvd., Detroit, Mich.

BARRELS (Steel)

Pressed Steel Tank Co., 1461 S. 66th St., Milwaukee, Wis.

BARRELS (Tumbling)

Ransohoff, N., Inc., 1317 Township Ave., Cincinnati, O.

BARS (Alloy)

Allegheny Ludlum Steel Corp.,
2319 Oliver Building (22)
Pittsburgh, Pa.
Ampco Metal, Inc., Dept. S-1,
3830 W. Burnham St.,
Milwaukee, Wis.
Bethlehem Steel Co.,
Bethlehem, Pa.
Bliss & Laughlin, Inc.,
Harvey, Ill.
Carnegie-Illinois Steel Corp.,
Pittsburgh-Chicago.
Carpenter Steel Co., Reading, Pa.
Columbia Steel Co.,
San Francisco, Calif.
Copperweld Steel Co., Warren, O.
Firth-Sterling Steel Co.,
McKeesport, Pa.
International Nickel Co. Inc., The,
67 Wall Street, New York City.
Kloster Steel Corp., 224-228 N. Justine St., Chicago, Ill.
LaSalle Steel Co., Chicago, Ill.
Latrobe Electric Steel Co.,
Latrobe, Pa.
Midvale Co., The,
Nicetown, Philadelphia, Pa.
Monarch Steel Co., 545 W. McCarty St., Indianapolis, Ind.
Republic Steel Corp.,
Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc.,
16th & Rockwell Sts., Chicago, Ill.
Taylor-Wharton Iron & Steel Co.,
High Bridge, N. J.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg.,
Birmingham, Ala.
Timken Roller Bearing Co., The,
Steel & Tube Div., Canton, O.
Wyckoff Drawn Steel Co., 1st National Bank Bldg., Pittsburgh, Pa.
Youngstown Sheet & Tube Co., The,
Youngstown, O.

BARS (Aluminum, Brass, Bronze or Copper)

Aluminum Co. of America,
2112 Gulf Bldg., Pittsburgh, Pa.
American Brass Co., The,
Waterbury, Conn.
Bridgeport Brass Co.,
Bridgeport, Conn.
Copperweld Steel Co., Warren, O.
Johnson Bronze Co.,
550 S. Mill St., New Castle, Pa.
National Bearing Metals Corp.,
4930 Manchester Ave.,
St. Louis, Mo.
Revere Copper & Brass, Inc.,
230 Park Ave., New York City.
Shenango-Penn Mold Co.,
407 W. Third St., Dover, O.

BARS (Concrete Reinforcing)

Bethlehem Steel Co.,
Bethlehem, Pa.
Carnegie-Illinois Steel Corp.,
Pittsburgh-Chicago.
Columbia Steel Co.,
San Francisco, Calif.
Foster, L. B., Co., Inc.,
P. O. Box 1647, Pittsburgh, Pa.
Inland Steel Co.,
38 S. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp.,
Jones & Laughlin Bldg.,
Pittsburgh, Pa.
Laclede Steel Co., Arcade Bldg.,
St. Louis, Mo.
Republic Steel Corp.,
Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc.,
16th & Rockwell Sts., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg.,
Birmingham, Ala.
Youngstown Sheet & Tube Co., The,
Youngstown, O.

BARS (Iron) See IRON (Bar)

BARS (Magnesium)

Dow Chemical Co., The,
Midland, Mich.

BARS (Steel) (*Also Stainless)

*Allegheny Ludlum Steel Corp.,
2319 Oliver Bldg., (22)
Pittsburgh, Pa.
*Bethlehem Steel Co.,
Bethlehem, Pa.
*Carnegie-Illinois Steel Corp.,
Pittsburgh-Chicago.
*Carpenter Steel Co., Reading, Pa.
Columbia Steel Co.,
San Francisco, Calif.
Continental Steel Corp.,
Kokomo, Ind.
*Copperweld Steel Co., Warren, O.
Enterprise Galvanizing Co.,
2525 E. Cumberland St.,
Philadelphia, Pa.
*Firth-Sterling Steel Co.,
McKeesport, Pa.
Inland Steel Co.,
38 S. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp.,
Jones & Laughlin Bldg.,
Pittsburgh, Pa.
*Kloster Steel Corp., 224-228 N. Justine St., Chicago, Ill.
*Midvale Co., The,
Nicetown, Philadelphia, Pa.
Milton Mfg. Co., The, Milton, Pa.
Purdy, A. R., Co., Inc., 792 Greenwich St., New York City.
*Republic Steel Corp., Dept. ST, Cleveland, O.
*Ryerson, Jos. T., & Son, Inc.,
16th & Rockwell Sts., Chicago, Ill.
*Scully Steel Products Co.,
1316 Wabansia Ave., Chicago, Ill.
Stanley Works, The,
New Britain, Conn.
Bridgeport, Conn.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg.,
Birmingham, Ala.
Timken Roller Bearing Co., The,
Canton, O.
Weirton Steel Co., Weirton, W. Va.
Youngstown Sheet & Tube Co., The,
Youngstown, O.

BATHS (Heat Treating, Cyanide, Salt)

Holden, A. F., Co., The, 200 Winchester Ave., New Haven, Conn.
Mahr Mfg. Co., 1702 N. Second St., Minneapolis, Minn.

BATTERIES (Storage)

Edison Storage Battery Div. of Thomas A. Edison, Inc.,
West Orange, N. J.
Electric Storage Battery Co., The,
19th St. and Allegheny Ave.,
Philadelphia, Pa.
Graybar Electric Co., 420 Lexington Ave., New York City.

BATTERY CHARGING APPARATUS

Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.
Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.
General Electric Co., Sec. H, 750-159, Schenectady, N. Y.
Graybar Electric Co., 420 Lexington Ave., New York City
Mallory, P. R., & Co.,
3029 E. Washington Ave.,
Indianapolis, Ind.
Ward Leonard Electric Co.,
Mt. Vernon, N. Y.
Westinghouse Electric & Mfg. Co.,
Dept. 7-N, E. Pittsburgh, Pa.

BEAMS, CHANNELS, ANGLES ETC. (*Also Stainless)

Aluminum Co. of America,
2112 Gulf Bldg., Pittsburgh, Pa.
Bethlehem Steel Co.,
Bethlehem, Pa.
*Carnegie-Illinois Steel Corp.,
Pittsburgh-Chicago.
Columbia Steel Co.,
San Francisco, Calif.
Enterprise Galvanizing Co.,
2525 E. Cumberland St.,
Philadelphia, Pa.
Inland Steel Co.,
38 S. Dearborn St., Chicago, Ill.
International Nickel Co., Inc., The,
67 Wall St., New York City
Jones & Laughlin Steel Corp.,
Jones & Laughlin Bldg.,
Pittsburgh, Pa.
Laclede Steel Co., Arcade Bldg.,
St. Louis, Mo.
Levinson Steel Sales Co., The,
33 Pride St., Pittsburgh, Pa.
*Ryerson, Jos. T., & Son, Inc.,
16th & Rockwell Sts., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg.,
Birmingham, Ala.
Weirton Steel Co., Weirton, W. Va.
Youngstown Sheet & Tube Co., The,
Youngstown, O.

BEAMS, CHANNELS, ANGLES, ETC. (Magnesium)

Dow Chemical Co., The,
Midland, Mich.

BEARINGS (Aluminum, Brass or Bronze)

Aluminum Co. of America,
2112 Gulf Bldg., Pittsburgh, Pa.
Ampco Metal, Inc., Dept. S-1,
3830 W. Burnham St.,
Milwaukee, Wis.
Cadman, A. W., Mfg. Co., 2816 Smallman St., Pittsburgh, Pa.
Howard Foundry Co., 4918 Bloomingdale Rd., Chicago, Ill.
Johnson Bronze Co.,
550 S. Mill St., New Castle, Pa.
National Bearing Metals Corp.,
4930 Manchester Ave.,
St. Louis, Mo.
Shenango-Penn Mold Co.,
407 W. Third St., Dover, O.

BEARINGS (Babbitt)

Johnson Bronze Co.,
550 S. Mill St., New Castle, Pa.
Link-Belt Co., 2410 W. 18th St.,
Chicago, Ill.
National Bearing Metals Corp.,
4930 Manchester Ave.,
St. Louis, Mo.
National Lead Co., 111 Broadway,
New York City

BEARINGS (Ball)

Ahlberg Bearing Co.,
3015 W. 47th St., Chicago, Ill.
Bantam Bearings Corp.,
South Bend, Ind.
Dodge Manufacturing Corp.,
Mishawaka, Ind.
Fafnir Bearing Co.,
New Britain, Conn.
Link-Belt Co., 519 N. Holmes Ave.,
Indianapolis, Ind.
New Departure Div., General Motors Corp., Bristol, Conn.
Norma-Hoffmann Bearings Corp.,
Stamford, Conn.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.
Torrington Co., The,
Torrington, Conn.

BEARINGS (Graphite)

National Carbon Co., W. 117th St. & Madison Ave., Cleveland, Ohio.
United States Graphite Co., The,
Saginaw, Mich.

BEARINGS (Journal)

Ahlberg Bearing Co.,
3015 W. 47th St., Chicago, Ill.
Bantam Bearings Corp.,
South Bend, Ind.
Dodge Manufacturing Corp.,
Mishawaka, Ind.
Fafnir Bearing Co.,
New Britain, Conn.
Hyatt Bearings Division, General Motors Corp., Harrison, N. J.
Link-Belt Co., 2410 W. 18th St.,
Chicago, Ill.
National Bearing Metals Corp.,
4930 Manchester Ave.,
St. Louis, Mo.
National Lead Co., 111 Broadway,
New York City
Norma-Hoffman Bearings Corp.,
Stamford, Conn.
Rollway Bearing Co., Inc.,
541 Seymour Ave., Syracuse, N. Y.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.
Timken Roller Bearing Co., The,
Canton, O.

BEARINGS (Needle)

Bantam Bearings Corp. South Bend, Indiana.
Torrington Co., The,
Torrington, Conn.

BEARINGS (Non-Metallic)

Ryerson, Jos. T., & Son, Inc.,
16th & Rockwell Sts., Chicago, Ill.

BEARINGS (Oilless)

Johnson Bronze Co., Mill St.,
New Castle, Pa.
Rhoades, R. W., Metaline Co.,
50-17 Fifth St., Long Island City, N. Y.

BEARINGS (Quill)

Bantam Bearings Corp.,
South Bend, Ind.

BEARINGS (Radial)

Ahlberg Bearing Co.,
3015 W. 47th St., Chicago, Ill.
American Roller Bearing Co.,
416 Melwood St., Pittsburgh, Pa.
Bantam Bearings Corp., South Bend, Indiana.
Fafnir Bearing Co.,
New Britain, Conn.
Hyatt Bearings Div., General Motors Corp., Harrison, N. J.
Link-Belt Co., 519 N. Holmes Ave.,
Indianapolis, Ind.
New Departure Div., General Motors Corp., Bristol, Conn.
Norma-Hoffman Bearings Corp.,
Stamford, Conn.
Rollway Bearing Co., Inc.,
541 Seymour Ave., Syracuse, N. Y.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.
Timken Roller Bearing Co., The,
Canton, O.

BEARINGS (Roll Neck)

American Roller Bearing Co., 416 Melwood St., Pittsburgh, Pa.
Bantam Bearings Corp.,
South Bend, Ind.
Fafnir Bearing Co.,
New Britain, Conn.
Hyatt Bearings Div., General Motors Corp., Harrison, N. J.
Morgan Construction Co.,
Worcester, Mass.
National Bearing Metals Corp.,
928 Shore Ave., Pittsburgh, Pa.
Norma-Hoffmann Bearings Corp.,
Stamford, Conn.
Rollway Bearing Co., Inc.,
541 Seymour Ave., Syracuse, N. Y.
Ryerson, Jos. T., & Son, Inc.,
16th & Rockwell Sts., Chicago, Ill.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.
Timken Roller Bearing Co., The,
Canton, O.

BEARINGS (Roller)

Ahlberg Bearing Co.,
3015 W. 47th St., Chicago, Ill.
American Roller Bearing Co.,
416 Melwood St., Pittsburgh, Pa.
Bantam Bearings Corp.,
South Bend, Ind.
Fafnir Bearing Co.,
New Britain, Conn.
Dodge Manufacturing Co.,
Mishawaka, Ind.
Hyatt Bearings Div., General Motors Corp., Harrison, N. J.
Link-Belt Co., 519 N. Holmes Ave.,
Indianapolis, Ind.
Norma-Hoffmann Bearings Corp.,
Stamford, Conn.
Rollway Bearing Co., Inc.,
541 Seymour Ave., Syracuse, N. Y.

BEARINGS (Roller)—Con.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.
Standard Machinery Co., Providence, R. I.
Timken Roller Bearing Co., The, Canton, O.

BEARINGS (Roller Tapered)
Ahlberg Bearing Co., 3015 W. 47th St., Chicago, Ill.
Bantam Bearings Corp., South Bend, Indiana.
Dodge Manufacturing Corp., Mishawaka, Ind.
Timken Roller Bearing Co., The, Canton, O.

BEARINGS (Rolling Mill)
American Roller Bearing Co., 416 Melwood St., Pittsburgh, Pa.
Bantam Bearings Corp., South Bend, Ind.
Hyatt Bearings Div., General Motors Corp., Harrison, N. J.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis, Ind.
Morgan Construction Co., Worcester, Mass.
National Bearing Metals Corp., 928 Shore Ave., Pittsburgh, Pa.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.
Timken Roller Bearing Co., The, Canton, O.

BEARINGS (Sealed)
Norma-Hoffmann Bearings, Corp., Stamford, Conn.

BEARINGS (Shaft Hanger)
Dodge Manufacturing Corp., Mishawaka, Ind.
Norma-Hoffmann Bearings Corp., Stamford, Conn.

BEARINGS (Thrust)
Ahlberg Bearing Co., 3015 W. 47th St., Chicago, Ill.
American Roller Bearing Co., 416 Melwood St., Pittsburgh, Pa.
Bantam Bearings Corp., South Bend, Ind.
Fafnir Bearing Co., New Britain, Conn.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Roilway Bearing Co., Inc., 541 Seymour Ave., Syracuse, N. Y.
SKF Industries, Inc., Front St., and Erie Ave., Philadelphia, Pa.
Timken Roller Bearing Co., The, Canton, O.

BELTING (Metal, Conveyor, High and Low Temperature)
Cyclone Fence Div. American Steel & Wire Co., Waukegan, Ill.

BELTING (Nonmetallic Conveyor)
Manheim Belting & Mfg. Co., Manheim, Pa.

BENDING AND STRAIGHTENING MACHINES
Alliance Machine Co., The, Alliance, O.
American Foundry Equipment Co., The, Mishawaka, Ind.
Baldwin Southark Div., Baldwin Locomotive Works, Philadelphia, Pa.
Beatty Machine & Mfg. Co., Hammond, Ind.
Cleveland Crane & Engineering Co., The, Steelweld Machinery Div., The, 1125 E. 283rd St., Wickliffe, O.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.
Consolidated Machine Tool Corp., Winton & Blossom Roads, Rochester, N. Y.
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.
Farquhar, A. B., Co., Ltd., 195 Duke St., York, Pa.
Hanniffin Mfg. Co., 621-631 S. Kolmar Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Kane & Roach, Inc., Niagara & Shonnard Sts., Syracuse, N. Y.
Kardong Bros., Inc., 346 Buchanan St., Minneapolis, Minn.
Logemann Brothers Co., 3126 Burleigh St., Milwaukee, Wis.
Morgan Engineering Co., The, Alliance, O.
O'Neil-Irwin Mfg. Co., 304 8th Ave. S., Minneapolis, Minn.
Thomas Machine Mfg. Co., Etna Branch P. O., Pittsburgh, Pa.
Watson-Stillman Co., Roselle, N. J.
Webb Corp., The, Webb City, Mo.

BENZOL AND TOLUOL RECOVERY PLANTS
Koppers Co., Engineering and Construction Div., 901 Koppers Bldg., Pittsburgh, Pa.

BILLETS (Alloy and Carbon Steel)
Alan Wood Steel Co., Conshohocken, Pa.
Andrews Steel Co., The, Newport, Ky.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Firth-Sterling Steel Co., McKeesport, Pa.
Keystone Steel & Wire Co., Dept. AC, Peoria, Ill.
Kloster Steel Corp., 224-228 N. Justine St., Chicago, Ill.
Republic Steel Corp., Dept. ST, Cleveland, O.
Roebling's, John A., Sons Co., Trenton, N. J.
Stanley Works, The, New Britain, Conn. Bridgeport, Conn.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.
Washburn Wire Co., Phillipsdale, R. I.
Youngstown Sheet & Tube Co., The Youngstown, O.

BILLETS (Forging)
Alan Wood Steel Co., Conshohocken, Pa.
Andrews Steel Co., The, Newport, Ky.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Carpenter Steel Co., Reading, Pa.
Copperweld Steel Co., Warren, O.
Heppenstall Co., Box S-12 4620 Hatfield St., Pittsburgh, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
Midvale Co., The, Nicetown, Philadelphia, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.
Stanley Works, The, New Britain, Conn. Bridgeport, Conn.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.
Youngstown Sheet & Tube Co., The, Youngstown, O.

BILLETS AND BLOOMS (*Also Stainless)
*Alan Wood Steel Co., Conshohocken, Pa.
Andrews Steel Co., The, Newport, Ky.
Bethlehem Steel Co., Bethlehem, Pa.
*Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Continental Steel Corp., Kokomo, Ind.
*Copperweld Steel Co., Warren, O.
*Firth-Sterling Steel Co., McKeesport, Pa.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
*Midvale Co., The, Nicetown, Philadelphia, Pa.
*Republic Steel Corp., Dept. ST, Cleveland, O.
Roebling's, John A., Sons Co., Trenton, N. J.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.
Stanley Works, The, New Britain, Conn. Bridgeport, Conn.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Timken Roller Bearing Co., The Steel & Tube Div., Canton, O.
Youngstown Sheet & Tube Co., The, Youngstown, O.

BILLETS—ALUMINUM (Forging)
Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh, Pa.

BIMETALS
Mallory & Co., P. R., 3029 E. Washington Ave., Indianapolis, Ind.

BLACKING (Graphite)
United States Graphite Co., The, Saginaw, Mich.

BLAST CLEANING EQUIPMENT (Sand)
American Foundry Equipment Co., The 509 S. Byrkit St., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.
Vapor Blast Mfg. Co., 333 S. 16th St., Milwaukee, Wis.

BLAST FURNACE AIR CONDITIONING
Koppers Co., Engineering & Construction Div., 300 Koppers Bldg., Pittsburgh, Pa.
Pritchard, J. F., & Co., Dwight Bldg., Kansas City, Mo.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Surface Combustion Div. of General Properties Co., Inc., 2375 Dorr St., Toledo, O.

BLAST FURNACE HOT BLAST STOVES
McKee, Arthur G., & Co., 2300 Chester Ave., Cleveland, O.

BLAST FURNACE SPECIALTIES
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Bailey, Wm. M., Co., 702 Magee Bldg., Pittsburgh, Pa.
Hays Corp., The, Michigan City, Ind.
Brosius, Edgar E., Co., Sharpsburg Branch, Pittsburgh, Pa.
McKee, Arthur G., & Co., 2300 Chester Ave., Cleveland, O.
Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.
Pritchard, J. F., & Co., Dwight Bldg., Kansas City, Mo.

BLAST FURNACE STOCK HOUSES
McKee, Arthur G., & Co., 2300 Chester Ave., Cleveland, O.

BLAST FURNACES—See FURNACES (Blast)

BLOCKS (Chain)
Link-Belt Co., 220 S. Belmont Ave., Indianapolis, Ind.
Reading Chain & Block Corp., Dept. D-10, Reading, Pa.

BLOWERS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Co., Sec. H, 750-159, Schenectady, N. Y.
Mahr Mfg. Co., 1702 N. Second St., Minneapolis, Minn.
North American Mfg. Co., The, 2910 E. 75th St., Cleveland, O.
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.

BLOWPIPES (Oxy-Acetylene)
Linde Air Products Co., The, 30 E. 42nd St., New York City.

BLUE PRINTING MACHINES AND ACCESSORIES
Wickes Brothers, Saginaw, Mich.

BOILER HEADS
Bethlehem Steel Co., Bethlehem, Pa.

BOILERS (Water Tube)
Babcock & Wilcox Co., The, 85 Liberty St., New York City.

BOILER TUBES—See TUBES (Boiler)

BOILERS
Oil Well Supply Co., Dallas, Texas.

BOLT AND NUT MACHINERY
Landis Machine Co., Waynesboro, Pa.
National Machinery Co., The, Tiffin, O.
Oster Mfg. Co., The, 2037 E. 61st St., Cleveland, O.

BOLT AND RIVET CUTTERS
Helwig Mfg. Co., Locust & 7th Sts., St. Paul, Minn.

BOLTS (*Also Stainless)
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Cleveland Cap Screw Co., 2917 E. 79th St., Cleveland, O.
Columbia Steel Co. San Francisco, Calif.
Harper, H. M., Co., The, 2646 Fletcher St., Chicago, Ill.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
Milton Mfg. Co., The, Milton, Pa.
*Oliver Iron & Steel Corp., S. 10th & Muriel Sts., Pittsburgh, Pa.
*Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
*Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.

BOLTS (Carriage and Machine)
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Cap Screw Co., 2917 E. 79th St., Cleveland, O.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
Oliver Iron & Steel Corp., S. 10 & Muriel Sts., Pittsburgh, Pa.
Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Triplex Screw Co., 5341 Grant Ave., Cleveland, O.

BOLTS (Non-Ferrous)
Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh, Pa.
Harper, H. M., Co., The, 2646 Fletcher St., Chicago, Ill.
Oliver Iron & Steel Corp., S. 10th & Muriel Sts., Pittsburgh, Pa.

BOLTS (Special)
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Cap Screw Co., 2917 E. 79th St., Cleveland, O.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
Oliver Iron & Steel Corp., S. 10th & Muriel Sts., Pittsburgh, Pa.
Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

BOLTS (Stove)
Central Screw Co., 3517 Shields Ave., Chicago, Ill.
Cleveland Cap Screw Co., 2917 E. 79th St., Cleveland, O.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.

BOLTS (Stove, Recessed Head)
Bristol Co., Waterbury, Conn.
Chandler Products Co., Euclid, O.
Continental Screw Co., New Bedford, Mass.
Corbin Screw Corp., New Britain, Conn.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.

BOLTS (Stove, Recessed Head)—Con.
National Screw & Mfg. Co., 2440 E. 75th St., Cleveland, O.
Pheoll Mfg. Co., 5700 Roosevelt Rd., Chicago, Ill.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Mfg. Co., Waterbury, Conn.

BOLTS (Track)
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
Oliver Iron & Steel Corp., S. 10th & Muriel Sts., Pittsburgh, Pa.
Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Youngstown Sheet & Tube Co., The, Youngstown, O.

BORING MACHINES (Precision)
Barnes, W. F. and John, Co., Rockford, Ill.
Consolidated Machine Tool Corp., Winton & Blossom Rds., Rochester, N. Y.
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.
Heald Machine Co., Worcester, Mass.
Ohio Machine Tool Co., The, Kenton, O.
Sellers, William, & Co., Inc., 16th & Callowhill Sts., Philadelphia, Pa.

BORING MACHINES (Special)
Barnes, W. F. and John, Co., Rockford, Ill.
Consolidated Machine Tool Corp., Winton & Blossom Rds., Rochester, N. Y.
Lempco Products Inc., Dept. SS, Bedford, O.
Van Norman Machine Tool Co., Springfield, Mass.

BORING MILLS (Vertical)
Bullard Co., The, Bridgeport, Conn.
Consolidated Machine Tool Corp., Winton & Blossom Rds., Rochester, N. Y.

BORING TOOLS (Carbide Tipped)
Carboloy Co., Inc., 11141 E. 8 Mile Rd., Detroit, Mich.
Genesee Tool Co., Fenton, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.

BOXES (Annealing)—See ANNEALING BOXES

BOXES (Open Hearth Charging)
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Mesta Machine Co., P. O., Box 1466, Pittsburgh, Pa.
Morgan Engineering Co., The, Alliance, O.
Pittsburgh Steel Foundry Corp., Glassport, Pa.
Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.

BOXES-SHOP (Steel)
All-Steel-Equip Co., Inc., 612 Archer Ave., Aurora, Ill.
American Metal Works, Inc., 1515 Germantown Ave., Philadelphia, Pa.

BOXES—STACKING (Steel)
All-Steel-Equip Co., Inc., 612 Archer Ave., Aurora, Ill.
American Metal Works, Inc., 1515 Germantown Ave., Philadelphia, Pa.

BRAKE LININGS
Johns-Manville Corp., 22 E. 40th St., New York City.
Wellman, The S. K., Co., 1374 E. 51st St., Cleveland, O.

BRAKES (Electric)
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.
Electric Controller & Mfg. Co., The, 2698 E. 79th St., Cleveland, O.
General Electric Co., Sec. H, 750-159, Schenectady, N. Y.

BRAKES (Hand)
O'Neil-Irwin Mfg. Co., 304 8th Ave. So., Minneapolis, Minn.

BRASS, BRONZE, COPPER, PHOSPHOR BRONZE
National Bearing Metals Corp., 928 Shore Ave., Pittsburgh, Pa.

BRICK (Abrasive)
Chicago Wheel & Manufacturing Co., Dept. ST, 1101 W. Monroe St., Chicago, Ill.

BRICK (Acid Resisting)
Harbison-Walker Refractories Co., Farmers Bank Bldg., Pittsburgh, Pa.
National Carbon Co., W. 117th St. & Madison Ave., Cleveland, O.
Quigley Co. Inc., 56 W. 45th St., New York City

BRICK (Chrome)
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh, Pa.

BRICK (Fire Clay)
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.
Harbison-Walker Refractories Co., Farmers Bank Bldg., Pittsburgh, Pa.
McLain Fire Brick Co., 1239 Gulf Bldg., Pittsburgh, Pa.

BRICK (Forsterite)
Harbison-Walker Refractories Co., Farmers Bank Bldg., Pittsburgh, Pa.

BRICK (High Alumina)
Harbison-Walker Refractories Co., Farmers Bank Bldg., Pittsburgh, Pa.

BRICK (Hot Top)
McLain Fire Brick Co., 1239 Gulf Bldg., Pittsburgh, Pa.

BRICK (Insulating)—See INSULATING BRICK

BRICK (Ladle)
Globe Brick Co., The, East Liverpool, O.
Harbison-Walker Refractories Co., Farmers Bank Bldg., Pittsburgh, Pa.
McLain Fire Brick Co., 1239 Gulf Bldg., Pittsburgh, Pa.

BRICK (Magnesia)
Harbison-Walker Refractories Co., Farmers Bank Bldg., Pittsburgh, Pa.

BRICK (Refractory)—See REFRACTORIES, CEMENT, ETC.

BRICK (Silica)
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh, Pa.

BRICK (Silicon Carbide)
Bay State Abrasive Products Co., Westboro, Mass.
Carborundum Co., The, Perth Amboy, N. J.
Norton Co., Worcester, Mass.

BRICK (Sleeves, Nozzles, Runners, Tuyeres)
Harbison-Walker Refractories Co., Farmers Bank Bldg., Pittsburgh, Pa.
McLain Fire Brick Co., 1239 Gulf Bldg., Pittsburgh, Pa.
National Fireproofing Corp., 202 E. Ohio St., Pittsburgh, Pa.

BRIDGE CRANES (Ore and Coal Handling)—See CRANES—BRIDGE (Ore & Coal Handling)

BRIDGES, BUILDINGS, VIADUCTS, STACKS, ETC.
American Bridge Co., Frick Bldg., Pittsburgh, Pa.
Belmont Iron Works, 22nd St. and Washington Ave., Philadelphia, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Blaw-Knox Co., Blawnox, Pa.
Columbia Steel Co., San Francisco, Calif.
Levinson Steel Sales Co., The, 33 Pride St., Pittsburgh, Pa.
Robertson, H. H., Co., Farmers Bank Bldg., Pittsburgh, Pa.

BROACHES
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, Mich.
Illinois Tool Works, 2501 N. Keeler Ave., Chicago, Ill.

BROACHING CUTTERS
Colonial Broach Co., P.O. Box No. 37, Harper Sta., Detroit, Mich.

BROACHING MACHINES
Cincinnati Milling Machine Co., Cincinnati, O.
Colonial Broach Co., 147 Jos. Campau, Detroit, Mich.

BRONZE—See BRASS, BRONZE, COPPER, PHOSPHOR BRONZE

BRUSHES
Fuller Brush Co., The, Hartford, Conn.

BRUSHES (Carbon)
National Carbon Co., W. 117th St., & Madison Ave., Cleveland, O.
United States Graphite Co., The, Saginaw, Mich.

BRUSHES (Industrial)
Fuller Brush Co., The, Hartford, Conn.

BUCKETS (Clam Shell, Dragline, Grab, Single Line)
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
Blaw-Knox Co., Blawnox, Pa.
Cullen-Friestedt Co., 1308 S. Kilbourn Ave., Chicago, Ill.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Industrial Brownhoist Corp., Bay City, Mich.
Osgood Co., The, Marion, O.
Owen Bucket Co., The, 6035 Breakwater Ave., Cleveland, O.

BUCKETS (Elevator)
Hendrick Mfg. Co., Carbondale, Pa.

BUCKETS (Single Hook, Automatic Dump, Automatic Single Line)
Brosius, Edgar E., Co., Sharpsburg Branch, Pittsburgh, Pa.
Wellman Engineering Co., The, 7016 Central Ave., Cleveland, O.

BUFFERS (Electric Portable)
Chicago Wheel & Manufacturing Co., Dept. ST, 1101 W. Monroe St., Chicago, Ill.
Graybar Electric Co., 420 Lexington Ave., New York City

BUILDINGS (Steel)—See BRIDGES BUILDINGS, ETC.

BULLDOZERS
Beatty Machine & Mfg. Co., Hammond, Ind.
Hanniffin Mfg. Co., 621-631 S. Kolmar Ave., Chicago, Ill.
Logemann Brothers Co., 3126 Burleigh St., Milwaukee, Wis.
Watson-Stillman Co., Roselle, N. J.

BURNERS (Acetylene)—See TORCHES AND BURNERS

BURNERS (Automatic)
Bloom Engineering Co., 916 Behan St., Pittsburgh, Pa.
Kemp, C. M., Mfg. Co., 405 E. Oliver St., Baltimore, Md.
North American Mfg. Co., The, 2910 E. 75th St., Cleveland, O.
Peabody Engineering Corp. 580 Fifth Ave., New York City.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh, Pa.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Surface Combustion Div. of General Properties Co., Inc., 2375 Dorr St., Toledo, O.
Wean Engineering Co., Warren, O.
Wilson, Lee, Engineering Co., 20005 Lake Rd., Cleveland, O.

BURNERS (Pulverized Coal, Oil, Gas, Combination)
American Gas Furnace Co., Elizabeth, N. J.
Babcock & Wilcox Co., The, 85 Liberty St., New York City.
Bloom Engineering Co., 916 Behan St., Pittsburgh, Pa.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Johnson Gas Appliance Co., 591 "E" Ave., N.W., Cedar Rapids, Iowa
Maehler, Paul, Co., The, 2208 W. Lake St., Chicago, Ill.
Mahr Mfg. Co., 1702 N. Second St., Minneapolis, Minn.
North American Mfg. Co., The, 2910 E. 75th St., Cleveland, O.
Peabody Engineering Corp., 580 Fifth Ave., New York City.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh, Pa.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Surface Combustion Div. of General Properties Co., Inc., 2375 Dorr St., Toledo, O.
Wean Engineering Co., Warren, O.
Wilson, Lee, Engineering Co., 20005 Lake Rd., Cleveland, O.

BUSHINGS (Bronze)
Ampco Metal, Inc., Dept. S-1, 3830 W. Burnham St., Milwaukee, Wis.
Cadman, A. W., Mfg. Co., 2816 Smallman St., Pittsburgh, Pa.
Johnson Bronze Co., 550 S. Mill St., New Castle, Pa.
National Bearing Metals Corp., 4930 Manchester Ave., St. Louis, Mo.
Shenango-Penn Mold Co., 407 W. Third St., Dover, O.

BUSHINGS (Jig)
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.

BUSHINGS (Oilless)
Rhoades, R. W., Metaline Co., 50-17 Fifth St., Long Island City, N. Y.

BY-PRODUCT PLANTS
Koppers Co., Engineering and Construction Div., 901 Koppers Bldg., Pittsburgh, Pa.

CABINETS (Refrigeration)
General Electric Company (Air Conditioning & Commercial Refrigeration Dept., Div. 431), Bloomfield, N. J.
Westinghouse Electric & Mfg. Co., Mansfield, O.

CABINETS (Steel)
Republic Steel Corp., Berger Mfg. Div., Canton, O.

CADMIUM
Udylite Corp., The, 1651 E. Grand Blvd., Detroit, Mich.

CADMIUM PLATING PROCESSES AND EQUIPMENT
Udylite Corp., The, 1651 E. Grand Blvd., Detroit, Mich.

CALCIUM METAL AND ALLOYS
Electro Metallurgical Co., 30 E. 42nd St., New York City.

CAISSONS (Pneumatic)
Dravo Corp., (Contracting Div.), Neville Island, Pittsburgh, Pa.

CAP SCREWS—See SCREWS (Cap, Set, Safety-Set)

CAPACITATORS (Electric)
Mallory & Co., P. R., 3029 E. Washington Ave., Indianapolis, Ind.

CAPSTANS (Electric, Gasoline, Diesel)
Silent Hoist Winch & Crane Co., 849 63rd St., Brooklyn, N. Y.

CAR DUMPERS
Alliance Machine Co., The, Alliance, O.
Industrial Brownhoist Corp., Bay City, Mich.
Link-Belt Co., 300 W. Pershing Road, Chicago, Ill.
Wellman Engineering Co., The, 7000 Central Ave., Cleveland, O.

CAR PULLERS and SPOTTERS
American Engineering Co., 2484 Aramingo Ave., Philadelphia, Pa.
Cullen-Friestedt Co., 1308 S. Kilbourn Ave., Chicago, Ill.
Diamond Iron Works, Inc., Minneapolis, Minn.
Link-Belt Co., 2410 W. 18th St., Chicago, Ill.
Silent Hoist Winch and Crane Co., 849 63rd St., Brooklyn, N. Y.

CARBIDE
Linde Air Products Co., The, 30 E. 42nd St., New York City.
National Carbide Corp., 60 E. 42nd St., New York City.
National Cylinder Gas Co., 205 W. Wacker Dr., Chicago, Ill.

CARBIDE METALS (Special Parts)
Firth-Sterling Steel Co., McKeesport, Pa.
McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.

CARBIDE TOOLS (Steel Cutting)
Carboloy Co., Inc., 11141 E. 8 Mile Rd., Detroit, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Genesee Tool Co., Fenton, Mich.
McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.

CARBON SPECIALTIES
National Carbon Co., W. 117th St. & Madison Ave., Cleveland, O.
United States Graphite Co., The, Saginaw, Mich.

CARBURIZING (Pack or Gas)
Lakeside Steel Improvement Co., The, 5418 Lakeside Ave., Cleveland, O.

CARS (Charging)
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Morgan Engineering Co., The, Alliance, O.
Pittsburgh Steel Foundry Corp., Glassport, Pa.
Pollock, Wm. B. Co., The, 101 Andrews Ave., Youngstown, O.

CARS (Dump)
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
Easton Car & Construction Co., Easton, Pa.
Pressed Steel Car Co., (Koppel Div.) Koppers Bldg., Pittsburgh, Pa.

CARS (Hot Metal Transfer)
Bartlett Hayward Div., Koppers Co., Baltimore, Md.
Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.

CARS (Industrial and Mining)
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Easton Car & Construction Co., Easton, Pa.
Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.
Pressed Steel Car Co., (Koppel Div.) Koppers Bldg., Pittsburgh, Pa.

CARS (Scale)
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.

CASTING WASHER EQUIPMENT
Pangborn Corp., Hagerstown, Md.
Vapor Blast Mfg. Co., 333 S. 10th St., Milwaukee, Wis.

CASTINGS (Acid Resisting)
Allegheny Ludlum Steel Corp., 2319 Oliver Bldg., (22), Pittsburgh, Pa.
Ampco Metal, Inc., Dept. S-1, 3830 W. Burnham St., Milwaukee, Wis.
Babcock & Wilcox Co., The, 85 Liberty St., New York City.
Cadman, A. W., Mfg. Co., 2816 Smallman St., Pittsburgh, Pa.
International Nickel Co., Inc., The, 67 Wall St., New York City.
Lebanon Steel Foundry, Lebanon, Pa.
Midvale Co., The, Nicetown, Philadelphia, Pa.
National Alloy Steel Div. of Blaw-Knox Co., Blawnox, Pa.
National Bearing Metals Corp., 928 Shore Ave., Pittsburgh, Pa.
Shenango-Penn Mold Co., 407 W. Third St., Dover, O.

CASTINGS (Alloy Iron)
National Alloy Steel Div. of Blaw-Knox Co., Blawnox, Pa.

CASTINGS (Alloy Steel)
Allegheny Ludlum Steel Corp., 2319 Oliver Building (22) Pittsburgh, Pa.
Babcock & Wilcox Co., The, 85 Liberty St., New York City.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Electro Alloys Co., The, Elyria, O.
Erie Forge Co., W. 15th & Cascade Sts., Erie, Pa.
Lebanon Steel Foundry, Lebanon, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Michiana Products Co., Michigan City, Ind.
National Alloy Steel Div. of Blaw-Knox Co., Blawnox, Pa.
National-Erie Corp., Erie, Pa.
Ohio Steel Foundry Co., Lima, O.-Springfield, O.
Pittsburgh Rolls Div., Blaw-Knox Co., Pittsburgh, Pa.
Pittsburgh Steel Foundry Corp., Glassport, Pa.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.
Union Steel Castings Div. of Blaw-Knox Co., 62nd & Butler Sts., Pittsburgh, Pa.
United Engineering & Foundry Co., 1st National Bank Bldg., Pittsburgh, Pa.
Youngstown Alloy Casting Corp., 103 E. Indianola Ave., Youngstown, O.

CASTINGS (Aluminum, Brass, Bronze, Copper)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh, Pa.
Ampco Metal, Inc., Dept. S-1, 3830 W. Burnham St., Milwaukee, Wis.
Bartlett-Hayward Div., Koppers Co., Baltimore, Md.
Bethlehem Steel Co., Bethlehem, Pa.
Cadman, A. W., Mfg. Co., 2816 Smallman St., Pittsburgh, Pa.
Century Foundry Co., 3727 Market St., St. Louis, Mo.
Doyle, The, J. E., Co., 1220 West 6th St., Cleveland, O.
Grinnell Co., Inc., Providence, R. I.
Homestead Valve Mfg. Co., P. O. Box 22, Coraopolis, Pa.
Howard Foundry Co., 4918 W. Bloomingdale Ave., Chicago, Ill.
Johnson Bronze Co., Mill St., New Castle, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Morgan Engineering Co., The, Alliance, O.
National Bearing Metals Corp., 4930 Manchester Ave., St. Louis, Mo.
Shenango-Penn Mold Co., 407 W. Third St., Dover, O.
Titan Metal Mfg. Co., Bellefonte, Pa.
Wellman Bronze & Aluminum Co., The, 2539 E. 93 St., Cleveland, O.

CASTINGS (Brass, Pressure)
Titan Metal Mfg. Co., Bellefonte, Pa.

CASTINGS (Corrosion Resisting)
Allegheny Ludlum Steel Corp., 2319 Oliver Bldg., (22), Pittsburgh, Pa.
International Nickel Co., Inc., The, 67 Wall St., New York City
Lebanon Steel Foundry, Lebanon, Pa.
Michiana Products Corp., Michigan City, Ind.
Midvale Co., The, Nicetown, Philadelphia, Pa.
National Alloy Steel Div. of Blaw-Knox Co., Blawnox, Pa.
National Lead Co., 111 Broadway, New York City
Wall-Colmonoy Corp., 720 Fisher Bldg., Detroit, Mich.

CASTINGS (Electric Steel)
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Erie Forge Co., W. 15th & Cascade Sts., Erie, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Lebanon Steel Foundry, Lebanon, Pa.
National-Erie Corp., Erie, Pa.
Reading Steel Casting Div. of American Chain & Cable Co. Inc., Reading, Pa.
Union Spring & Mfg. Co., New Kensington, Pa.
West Steel Casting Co., The, 805 E. 70th St., Cleveland, O.
Youngstown Alloy Casting Corp., 103 E. Indianola Ave., Youngstown, O.

CASTINGS (Gray Iron, Alloy or Semi-Steel)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Engineering Co., 2484 Aramingo Ave., Philadelphia, Pa.
Bartlett-Hayward Div., Koppers Co., Baltimore, Md.
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Brown, Inc., 456 So. Main St., Lima, O.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Century Foundry Co., 3727 Market St., St. Louis, Mo.
Columbia Steel Co., San Francisco, Calif.
Davenport-Besler Corp., Davenport, Iowa
Diamond Iron Works, Inc., Minneapolis, Minn.
Erie Foundry Co., Erie, Pa.
Grinnell Co., Inc., Providence, R. I.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Hyde Park Foundry & Machine Co., Hyde Park, Pa.
International Nickel Co., Inc., The, 67 Wall St., New York City
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Midvale Co., The, Nicetown, Philadelphia, Pa.
National Roll & Foundry Co., The, Avonmore, Pa.
Oil Well Supply Co., Dallas, Texas,
Shenango-Penn Mold Co., 407 W. Third St., Dover, O.

CASTINGS (Heat Resisting)
Allegheny Ludlum Steel Corp., 2319 Oliver Bldg., (22), Pittsburgh, Pa.
Babcock & Wilcox Co., The, 85 Liberty St., New York City.
Electro Alloys Co., The, Elyria, O.
International Nickel Co. Inc., The, 67 Wall Street, New York City.
Lebanon Steel Foundry, Lebanon, Pa.
Michiana Products Co., Michigan City, Ind.
Midvale Co., The, Nicetown, Philadelphia, Pa.
National Alloy Steel Div. of Blaw-Knox Co., Blawnox, Pa.
Shenango-Penn Mold Co., 407 W. Third St., Dover, O.

CASTINGS (Magnesium)
Dow Chemical Co., The, Midland, Mich.
Howard Foundry Co., 4918 W. Bloomingdale Ave., Chicago, Ill.

CASTINGS (Malleable)
American Chain & Cable Co. Inc., Bridgeport, Conn.
Grinnell Co., Inc., Providence, R. I.
Lake City Malleable Co., 5026 Lakeside Ave., Cleveland, O.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis, Ind.

CASTINGS (Steel) (*Also Stainless)
*Allegheny Ludlum Steel Corp., 2319 Oliver Bldg., (22) Pittsburgh, Pa.
Babcock & Wilcox Co., The, 85 Liberty St., New York City.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Continental Roll & Steel Fdry Co., E. Chicago, Ind.
Erie Forge Co., W. 15th & Cascade Sts., Erie, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
*Lebanon Steel Foundry, Lebanon, Pa.
Link-Belt Co., 300 W. Pershing Road, Chicago, Ill.
Mackintosh-Hemphill Co., 9th & Bingham Sts., Pittsburgh, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
*Michiana Products Co., Michigan City, Ind.
*Midvale Co., The, Nicetown, Philadelphia, Pa.
National-Erie Corp., Erie, Pa.
National Roll & Foundry Co., The, Avonmore, Pa.
Ohio Steel Fdry., Lima, O.-Springfield, O.
Oil Well Supply Co., Dallas, Texas.
Pittsburgh Rolls, Div. of Blaw-Knox Co., Pittsburgh, Pa.
Pittsburgh Steel Foundry Corp., Glassport, Pa.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.
Steel Founders' Society of America, 720 Midland Bldg., Cleveland, O.
Strong Steel Fdry. Co., Hertel & Norris Aves., Buffalo, N. Y.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Union Steel Casting Div. of Blaw-Knox Co., 62nd and Butler Sts., Pittsburgh, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.
West Steel Casting Co., The, 805 E. 70th St., Cleveland, O.
Youngstown Alloy Casting Corp., 103 E. Indianola Ave., Youngstown, O.

CASTINGS (Wear Resisting)
Hagan, George J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Lebanon Steel Foundry, Lebanon, Pa.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis, Ind.
Michiana Products Corp., Michigan City, Ind.
Shenango-Penn Mold Co., 407 W. Third St., Dover, O.
Wall-Colmonoy Corp., 720 Fisher Bldg., Detroit, Mich.

CASTINGS (Worm and Gear Bronze)
Ampco Metal, Inc., Dept. S-1, 3830 W. Burnham St., Milwaukee, Wis.
Cadman, A. W., Mfg. Co., 2816 Smallman St., Pittsburgh, Pa.
National Bearing Metals Corp., 928 Shore Ave., Pittsburgh, Pa.

CEMENT (Acid Proof)
National Carbon Co., W. 117th St. & Madison Ave., Cleveland, O.
Quigley Company Inc., 56 W. 45th St., New York City.
Pennsylvania Salt Mfg. Co., Widener Bldg., Philadelphia, Pa.

CEMENT (Elastic)
Minnesota Mining & Mfg. Co., 900 Fauquier St., St. Paul, Minn.

CEMENT (High Temperature)

Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.
Bay State Abrasive Products Co., Westboro, Mass.
Carborundum Co., The, Perth Amboy, N. J.
Harbison-Walker Refractories Co., Farmers Bank Bldg., Pittsburgh, Pa.
Johns-Manville Corp., 22 E. 40th St., New York City.
Norton Company, Worcester, Mass.
Pennsylvania Salt Mfg. Co., Widener Bldg., Philadelphia, Pa.
Ramtite Co., The, Div. of the S. Obermayer Co., 2557 W. 18th St., Chicago, Ill.,

CEMENT (High Temperature Hydraulic)

Atlas Lumnite Cement Co. Dept. S, Chrysler Bldg., New York City.
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.
Ramtite Co., The, Div. of the S. Obermayer Co., 2557 W. 18th St., Chicago, Ill.

CENTRAL STATION EQUIPMENT

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Co., Sec. H, 750-159, Schenectady, N. Y.
Graybar Electric Co., 420 Lexington Ave., New York City
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa

CHAIN (Conveyor and Elevator)

Link-Belt Co., 220 S. Belmont Ave. Indianapolis, Ind.

CHAIN (Draw Bench)

Link-Belt Co., 220 S. Belmont Ave., Indianapolis, Ind.

CHAIN (Malleable)

Lake City Malleable Co., 5026 Lakeside Ave., Cleveland, O.

CHAIN (Power Transmission)

Link-Belt Co., 220 S. Belmont Ave., Indianapolis, Ind.

CHAIN (Roller)

Link-Belt Co., 220 S. Belmont Ave., Indianapolis, Ind.

CHAIN (Sling)

American Chain Div., American Chain & Cable Co., York, Pa.
McKay Co., The, York, Pa.

CHAIN (Welded & Weldless)

McKay Co., The, York, Pa.

CHANNELS—See BEAMS, CHANNELS, ANGLES

CHARGING MACHINES (Cupola)

Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
Morgan Engineering Co., The, Alliance, O.

CHARGING MACHINES (Open Hearth)

Morgan Engineering Co., The, Alliance, O.
Wellman Engineering Co., The, 7016 Central Ave., Cleveland, O.

CHARGING MACHINES AND MANIPULATORS (Autofloor Type)

Brosius, Edgar E., Co., Sharpsburg Branch, Pittsburgh, Pa.

CHECKER BRICK

Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.

CHECKS (Metal)

Cunningham, M. E., Co., 172 E. Carson St., Pittsburgh, Pa.
Matthews, Jas. H., & Co., 3978 Forbes St., Pittsburgh, Pa.

CHECKS (Time & Tool)

St. Louis Button Co., 413-415 Lucas Ave., St. Louis, Mo.

CHEMICAL PROCESSING EQUIPMENT

Struthers Wells Corp., Titusville, Pa.

CHEMICALS (Industrial)

Metal & Thermit Corp., 120 Broadway, New York City.
Park Chemical Co., 8076 Military Ave., Detroit, Mich.
Pennsylvania Salt Mfg. Co., Widener Bldg., Philadelphia, Pa.
Titanium Alloy Mfg. Co., The, Niagara Falls, N. Y.
Turco Products, Inc., 6135 S. Central Ave., Los Angeles, Calif.

CHROME MORTAR

Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.
Harbison-Walker Refractories Co., Farmers Bank Bldg., Pittsburgh, Pa.

CHROME ORE

Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.
Harbison-Walker Refractories Co., Farmers Bank Bldg., Pittsburgh, Pa.
Samuel, Frank, & Co., Inc., Harrison Bldg., Philadelphia, Pa.

CHROMIUM METAL AND ALLOYS

Electro Metallurgical Co., 30 E. 42nd St., New York City.
Metal & Thermit Corp., 120 Broadway, New York City.
Vanadium Corp., of America, 420 Lexington Ave., New York City.

CHROMIUM PLATING PROCESSES AND EQUIPMENT

United Chromium, Inc., 51 E. 42nd St., New York City.

CHUCK OPERATING CYLINDERS

Anker-Holth Mfg. Co.—Airgrip Chuck Div., 332 S. Michigan Ave., Chicago, Ill.

CHUCKING MACHINES (Multiple Spindle)

Bullard Co., The, Bridgeport, Conn.
National Acme Co., The, 170 E. 131st St., Cleveland, O.
Oster Mfg. Co., The, 2037 E. 61st St., Cleveland, O.

CHUCKS

Apex Machine & Tool Co., 1025 S. Patterson Blvd., Dayton, O.
Bullard Co., The, Bridgeport, Conn.

CHUCKS (Automatic Closing)

Anker-Holth Mfg. Co.—Airgrip Chuck Div., 332 S. Michigan Ave., Chicago, Ill.

CLAMPS, CABLE (Sheet Metal)

Prestole Div. Detroit Harvester Co., 4500 Detroit Ave., Toledo, O.
Tinnerman Products, Inc., 2039 Fulton Rd., Cleveland, O.

CLAMPS (Drop Forged)

Williams, J. H., & Co., 400 Vulcan St., Buffalo, N. Y.

CLEANERS (Air)

Westinghouse Electric & Mfg. Co., 1216 W. 58th St., Cleveland, O.

CLEANERS (Steam)

Homestead Valve Mfg. Co., P. O. Box 22, Coraopolis, Pa.

CLEANING EQUIPMENT (Metal)

American Foundry Equipment Co., The, Mishawaka, Ind.
Bullard Co., The, Bridgeport, Conn.
Detroit Rex Products Co., 13029 Hillview Ave., Detroit, Mich.
Pangborn Corporation Hagerstown, Md.
Ransohoff, N., Inc., 1317 Township Ave., Cincinnati, O.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Vapor Blast Mfg. Co., 333 S. 16th St., Milwaukee, Wis.

CLEANING SPECIALTIES

American Chemical Paint Co., Dept. 310, Ambler, Pa.
Detroit Rex Products Co., 13029 Hillview Ave., Detroit, Mich.
MacDermid, Inc., Waterbury, Conn.
Pennsylvania Salt Mfg. Co., Dept. S, Pennsalt Cleaner Div., Philadelphia, Pa.
Quigley Company, Inc., 56 W. 45th St., New York City
Turco Products, Inc., 6135 S. Central Ave., Los Angeles, Calif.

CLUTCH FACINGS

Johns-Manville Corp., 22 E. 40th St., New York City
Wellman, The S. K., Co., 1374 East 51st St., Cleveland, O.

CLUTCHES (Friction)

Diamond Iron Works, Inc., Minneapolis, Minn.
Dodge Manufacturing Corp., Mishawaka, Ind.
Jones, W. A., Fdry. & Mach. Co., 4437 Roosevelt Rd., Chicago, Ill.
Link-Belt Co., 300 W. Pershing Road, Chicago, Ill.

CLUTCHES (Magnetic)

Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.

COAL OR COKE

Alan Wood Steel Co., Conshohocken, Pa.
Cleveland-Cliffs Iron Co., The, Union Commerce Bldg., Cleveland, O.
Columbia Steel Co., San Francisco, Calif.
Hanna Furnace Corp., The, Ecorse, Detroit, Mich.
Koppers Co., Gas & Coke Div., 300 Koppers Bldg., Pittsburgh, Pa.
Koppers Coal Div., Eastern Gas & Fuel Assoc., 300 Koppers Bldg., Pittsburgh, Pa.
New England Coal & Coke Co., Boston, Mass.
Shenango Furnace Co., Oliver Bldg., Pittsburgh, Pa.
Snyder, W. P., & Co., Oliver Bldg., Pittsburgh, Pa.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Youngstown Sheet & Tube Co., The, Youngstown, O.

COAL, COKE, ORE, ASH HANDLING AND PROCESSING MACHINERY

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
Easton Car & Construction Co., Easton, Pa.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Industrial Brownhoist Corp., Bay City, Mich.
Koppers Co., Engineering & Construction Div., 901 Koppers Bldg., Pittsburgh, Pa.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Wellman Engineering Co., The 7000 Central Ave., Cleveland, O.

COILS (Direct Expansion)

General Electric Company (Air Conditioning & Commercial Refrigeration Dept. Div. 431), Bloomfield, N. J.
Westinghouse Electric & Mfg. Co., 653 Page Blvd., Springfield, Mass.

COILS (Water or Steam)

Flori Pipe Co., The, 5700 Bulwer Ave., St. Louis, Mo.
General Electric Company (Air Conditioning & Commercial Refrigeration Dept. Div. 431), Bloomfield, N. J.
Westinghouse Electric & Mfg. Co., 653 Page Blvd., Springfield, Mass.

COKE—See COAL or COKE

COKE OVEN MACHINERY

Alliance Machine Co., The, Alliance, O.
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
Koppers Co., Engineering & Construction Div., 300 Koppers Bldg., Pittsburgh, Pa.
Morgan Engineering Co., The, Alliance, O.

COKE OVENS (By-Product)

Koppers Co., Engineering and Construction Div., 901 Koppers Bldg., Pittsburgh, Pa.

COLUMBIUM

Electro Metallurgical Co., 30 E. 42nd St., New York City.

COMBUSTION BOATS

Carborundum Co., The, Niagara Falls, N. Y.
Norton Company, Worcester, Mass.

COMBUSTION CONTROLS

Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Hays Corp., The, 960 Eighth Ave., Michigan City, Ind.
Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.
Morgan Construction Co., Worcester, Mass.
Norton Company, Worcester, Mass.

COMPARATORS (Optical)

Jones & Lamson Machine Co., Springfield, Vt.

COMPENSATORS (Automatic)

Electric Controller & Mfg. Co., The, 2700 E. 79th St., Cleveland, O.
General Electric Co., Sec. H, 750-159, Schenectady, N. Y.
Graybar Electric Co., 420 Lexington Ave., New York City
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

COMPOUNDS (Case Hardening, Heat Treating, Polishing)

Park Chemical Co., 8076 Military Ave., Detroit, Mich.

COMPOUNDS (Coppering, Metal Finishing, Rust Removing, Rust Preventing)

American Chemical Paint Co., Ambler, Pa.

COMPOUNDS (Drawing)

Acheson Colloids Corp., Port Huron, Mich.

COMPRESSORS (Air)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Cooper-Bessemer Corp., The, Mt. Vernon, O.
Curtis Pneumatic Machinery Div. of Curtis Mfg. Co., 1996 Kienlen Ave., St. Louis, Mo.
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.
Worthington Pump & Machinery Corp., Harrison, N. J.

CONCRETE (Heat Resistant)

Atlas Lumnite Cement Co., Dept. S, Chrysler Bldg., New York City.
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.

CONCRETE REINFORCING BARS —See BARS (Concrete Reinforcing)

CONDENSERS (Surface, Barometric, Multi-Jet)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Company (Air Conditioning & Commercial Refrigeration Dept. Div. 431), Bloomfield, N. J.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
National Carbon Co., W. 117th St. & Madison Ave., Cleveland, O.
Ross Heater & Mfg. Co., 1407 West Ave., Buffalo, N. Y.
Westinghouse Electric & Mfg. Co., 653 Page Blvd., Springfield, Mass.
Worthington Pump & Machinery Corp., Harrison, N. J.

CONDUITS (Asbestos Cement)

Johns-Manville Corp., 22 E. 40th St., New York City

CONDUITS (Electric)

General Electric Co., Sec. H, 750-159, Schenectady, N. Y.
Bridgeport, Conn.
Graybar Electric Co., 420 Lexington Ave., New York City
Steel and Tubes Div., Republic Steel Corp., Cleveland, Ohio.
Younstown Sheet & Tube Co., The, Youngstown, O.

CONDUITS (Pressure-Treated Wood)

Koppers Co., Wood Preserving Div., 300 Koppers Bldg., Pittsburgh, Pa.

CONNECTING RODS

Bay City Forge Co., W. 19th and Cranberry Sts., Erie, Pa.
Heppenstall Co., Box S-12, 4620 Hatfield St., Pittsburgh, Pa.
Kropp Forge Co., 5301 W. Roosevelt Rd., Chicago, Ill.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.

CONTACTS & CONTACTORS (Electric)

Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.
Electric Controller & Mfg. Co., The, 2698 E. 79th St., Cleveland, O.
Graybar Electric Co., 420 Lexington Ave., New York City
Mallory, P. R., & Co., 3029 E. Washington Ave., Indianapolis, Ind.
National Carbon Co., W. 117th St. & Madison Ave., Cleveland, O.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

CONTRACT WORK

Commercial Metals Treating, Inc., Toledo, O.
Doyle, The, J. E., Co., 1220 West 6th St., Cleveland, O.
Kirk & Blum Mfg. Co., 2822 Spring Grove Ave., Cincinnati, O.
Milton Mfg. Co., Milton, Pa.
Nilson, A. H., Machine Co., Inc., Bridgeport, Conn.
Norlipp Co., The, 556 W. Congress St., Chicago, Ill.
North Wales Machine Co., Inc., North Wales, Pa.

CONTRACTORS—See ENGINEERS AND CONTRACTORS

CONTROL EQUIPMENT (Electric)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Electric Controller & Mfg. Co., The, 2698 E. 79th St., Cleveland, O.
General Electric Co., Sec. H, 750-159, Schenectady, N. Y.
Graybar Electric Co., 420 Lexington Ave., New York City
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

CONTROL SYSTEMS (Automatic)

Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Brown Instrument Div. of Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia, Pa.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Hays Corp., The, Michigan City, Ind
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia, Pa.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

CONTROLLERS (Electric)

Allen-Bradley Co., 1320 S. Second St., Milwaukee, Wis.
Allis-Chalmer Mfg. Co., Milwaukee, Wis.
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.
Electric Controller & Mfg. Co., The, 2698 E. 79th St., Cleveland, O.
General Electric Co., Sec. H, 750-159, Schenectady, N. Y.
Graybar Electric Co., 420 Lexington Ave., New York City
Ward Leonard Electric Co., Mt. Vernon, N. Y.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

CONTROLS (Combustion)—See COMBUSTION CONTROLS

CONTROLS—AUTOMATIC (For Boring Mills, Planers, Shapers, Lathes, Milling Machines)

Detroit Universal Duplicator Co., 218 St. Aubin, Detroit, Mich.

CONTROLS (Temperature)

Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Brown Instrument Div. of Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia, Pa.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Hays Corp., The, Michigan City, Ind.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia, Pa.
Ward Leonard Electric Co., Mt. Vernon, N. Y.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

CONVEYING SYSTEMS (Steam Jet)

Hagan, George J., Co., 2400 E. Carson St., Pittsburgh, Pa.

CONVEYOR BELTS

Manheim Belting & Mfg. Co., Manheim, Pa.

CONVEYOR BELTS (High & Low Temperature)

Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.

CONVEYOR BELTS (Wire)

Cyclone Fence Div., American Steel & Wire Co., Waukegan, Ill.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.

CONVEYORS (Apron)

Link-Belt Co., 300 W. Pershing Rd., Road, Chicago, Ill.
Mathews Conveyer Co., 142 Tenth St., Ellwood City, Pa.

CONVEYORS (Belt)

Bartlett, C. O., & Snow Co., 6200 Harvard Ave., Cleveland, O.
Diamond Iron Works, Inc., Minneapolis, Minn.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CONVEYORS (Chain)

Bartlett, C. O. & Snow Co., 6200 Harvard Ave., Cleveland, O.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis, Ind.
Mathews Conveyer Co., 142 Tenth St., Ellwood City, Pa.

CONVEYORS (Elevating)

Bartlett, C. O. & Snow Co. 6200 Harvard Ave., Cleveland, O.
Diamond Iron Works, Inc., Mineapolis, Minn.
Farquhar, A. B., Co., Ltd., York, Pa.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis, Ind.
Mathews Conveyer Co., 142 Tenth St., Ellwood City, Pa.

CONVEYORS (Overhead Trolley)

American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., 1125 E. 283rd St., Wickliffe, O.
Link-Belt Co., 2410 W. 18th St., Chicago, Ill.
Reading Chain & Block Corp., Dept. D-13, Reading, Pa.

CONVEYORS (Pneumatic)

Sturtevant, B. F., Co., Hyde Park, Boston, Mass.

CONVEYORS (Roller—Power and Gravity)

Bartlett, C. O. & Snow Co., 6200 Harvard Ave., Cleveland, O.
Mathews Conveyer Co., 142 Tenth St., Ellwood City, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.

CONVEYORS (Vibrating)

Allis-Chalmer Mfg. Co., Milwaukee, Wis.

COOLERS (Liquid)

Ross Heater & Mfg. Co., 1407 West Ave., Buffalo, N. Y.

COPPER—See BRASS, BRONZE, COPPER, PHOSPHOR BRONZE

COPPER (Phosphorized)

National Bearing Metals Corp., 928 Shore Ave., Pittsburgh, Pa.
Revere Copper & Brass, Inc. 230 Park Ave., New York City.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

CORE WASH

Acheson Colloids Corp., Port Huron, Mich.
United States Graphite Co., The, Saginaw, Mich.

COTTER PINS

American Chain Div., American Chain & Cable Co., Inc., York, Pa.
Hindley Mfg. Co., Valley Falls, R. I.
Hubbard, M. D., Spring Co., 449 Central Ave., Pontiac, Mich.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.

COUNTERBORES

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, Mich.
Genesee Tool Co., Fenton, Mich.

COUPLERS

Hunt, C. B., & Son, Salem, Ohio

COUPLINGS (Air Hose)

Hansen Manufacturing Co., The 1786 East 27th St., Cleveland, O.

COUPLINGS (Flexible)

American Flexible Coupling Div., J. A. Zum Mfg. Co., 18th & Pittsburgh Aves., Erie, Pa.
Bartlett-Hayward Div., Koppers Co., Baltimore, Md.
Electric Controller & Mfg. Co., The, 2700 E. 79th St., Cleveland, O.
Foote Bros. Gear & Machine Co., 5301 S. Western Blvd., Chicago, Ill.
General Electric Co., Sec. H, 750-159, Schenectady, N. Y.
Horsburgh & Scott Co., The, 5112 Hamilton Ave., Cleveland, O.
James, D. O., Mfg. Co., 1140 W. Monroe St., Chicago, Ill.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis, Ind.
Lovejoy Flexible Coupling Co., 4973 W. Lake St., Chicago, Ill.
Philadelphia Gear Works, Erie Ave. & G. St., Philadelphia, Pa.
Poole Fdy. & Mach. Co., Woodberry St., Baltimore, Md.
Waldron, John, Corp., New Brunswick, N. J.
Westinghouse Electric & Mfg. Co., 200 McCandless Ave., Pittsburgh, Pa.

COUPLINGS (Pipe)

Bethlehem Steel Co., Bethlehem, Pa.
National Tube Co., Frick Bldg., Pittsburgh, Pa.
Oil Well Supply Co., Dallas, Texas.
Republic Steel Corp., Dept. ST, Cleveland, O.
Youngstown Sheet & Tube Co., The, Youngstown, O.

CRANES (Charging)

Alliance Machine Co., The, Alliance, O.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Morgan Engineering Co., The, Alliance, O.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.

CRANES (Crawler, Erection)

Bucyrus-Erie Corp., South Milwaukee, Wis.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Hughes-Keenan Co., 585 Newman St., Mansfield, O.
Industrial Brownhoist Corp., Bay City, Mich.
Link-Belt Speeder Corp., 301 W. Pershing Rd., Chicago, Ill.
Northwest Engineering Co., 28 E. Jackson Blvd., Chicago, Ill.
Ohio Locomotive Crane Co., Bucyrus, O.
Osgood Co., The, Marion, O.

CRANES (Electric)

Alliance Machine Co., The, Alliance, O.
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Chicago Tramrail Co., 2910 W. Carroll Ave., Chicago, Ill.
Cleveland Crane & Engineering Co., The, 1125 E. 283rd St., Wickliffe, O.
Euclid Crane & Hoist Co., The, Chardon Rd., Euclid, O.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Manning, Maxwell & Moore, Inc., Shaw-Box Crane & Hoist Div., 406 Broadway, Muskegon, Mich.
Morgan Engineering Co., The, Alliance, O.
Reading Chain & Block Corp., Dept. D-13, Reading, Pa.
Shepard Niles Crane & Hoist Corp. 358 Schuyler Ave., Montour Falls, N. Y.

CRANES (Gantry)

Alliance Machine Co., The, Alliance, O.
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Cleveland Crane & Engineering Co., The, 1125 E. 283rd St., Wickliffe, O.
Cullen-Friestedt Co., 1308 S. Kilbourn Ave., Chicago, Ill.
Euclid Crane & Hoist Co., The, Chardon Rd., Euclid, O.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Industrial Brownhoist Corp., Bay City, Mich.
Morgan Engineering Co., The, Alliance, O.
Northwest Engineering Co., 28 E. Jackson Blvd., Chicago, Ill.
Ohio Locomotive Crane Co., Bucyrus, O.
Reading Chain & Block Corp., Dept. D-13, Reading, Pa.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave. Montour Falls, N. Y.

CRANES (Gasoline and Diesel)

Cullen-Friestedt Co., 1308 S. Kilbourn Ave., Chicago, Ill.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Industrial Brownhoist Corp., Bay City, Mich.
Northwest Engineering Co., 28 E. Jackson Blvd., Chicago, Ill.
Ohio Locomotive Crane Co., Bucyrus, O.
Silent Hoist Winch & Crane Co., 849 63rd St., Brooklyn, N. Y.

CRANES (Hand)

American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Chicago Tramrail Co., 2910 W. Carroll Ave., Chicago, Ill.
Cleveland Crane & Engineering Co., The, 1125 E. 283rd St., Wickliffe, O.
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., 1125 E. 283rd St., Wickliffe, O.
Curtis Pneumatic Machinery Div. of Curtis Mfg. Co., 1996 Kienlen Ave., St. Louis, Mo.
Euclid Crane & Hoist Co., The, Chardon Rd., Euclid, O.
Industrial Brownhoist Corp., Bay City, Mich.
Manning, Maxwell & Moore, Inc., Shaw-Box Crane & Hoist Div., 406 Broadway, Muskegon, Mich.
Reading Chain & Block Corp., Dept. D-13, Reading, Pa.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.
Wright Mfg. Div. of American Chain & Cable Co., Inc., York, Pa.

CRANES (Jib)

Alliance Machine Co., The, Alliance, O.
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Chicago Tramrail Co., 2910 W. Carroll Ave., Chicago, Ill.
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., 1125 E. 283rd St., Wickliffe, O.
Euclid Crane & Hoist Co., The, Chardon Rd., Euclid, O.

CRANES (Jib)—Con.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Industrial Brownhoist Corp., Bay City, Mich.
Link-Belt Speeder Corp., 301 W. Pershing Rd., Chicago, Ill.
Morgan Engineering Co., The Alliance, O.
Reading Chain & Block Corp., Dept. D-13, Reading, Pa.
Wright Mfg. Div. of American Chain & Cable Co. Inc., York, Pa.

CRANES (Locomotive)
Cullen-Friestedt Co., 1308 S. Kilbourn Ave., Chicago, Ill.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Industrial Brownhoist Corp., Bay City, Mich.
Northwest Engineering Co., 28 E. Jackson Blvd., Chicago, Ill.
Ohio Locomotive Crane Co., Bucyrus, O.
Osgood Co., The, Marion, O.
Silent Hoist Winch & Crane Co., 849 63rd St., Brooklyn, N. Y.

CRANES (Monorail)
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Chicago Tramrail Co., 2910 W. Carroll Ave., Chicago, Ill.
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., 1125 E. 283rd St., Wickliffe, O.
Euclid Crane & Hoist Co., The, Chardon Rd., Euclid, O
Reading Chain & Block Corp., Dept. D-13, Reading, Pa.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.

CRANES (Portable Industrial, Electric)
Baker-Raulang Co., The, 2167 W. 25th St., Cleveland, O.

CRANES (Traveling)
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Chicago Tramrail Co., 2910 W. Carroll Ave., Chicago, Ill.
Euclid Crane & Hoist Co., The, Chardon Rd., Euclid, O.
Reading Chain & Block Corp., Dept. D-13, Reading, Pa.
Wright Mfg. Div. of American Chain & Cable Co., Inc., York, Pa.

CRANES, BRIDGE (Ore and Coal Handling)
Alliance Machine Co., The Alliance, O.
Dravo Corp. (Engineering Works Div.), Neville Island, Pittsburgh, Pa.
Industrial Brownhoist Corp., Bay City, Mich.
Wellman Engineering Co., The, 7000 Central Ave., Cleveland, O.

CRANK SHAFTS
Bay City Forge Co., W. 19th and Cranberry Sts., Erie, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Erie Forge Co., W. 15th & Cascade Sts., Erie, Pa.
Kropp Forge Co., 5301 W. Roosevelt Rd., Chicago, Ill.
Midvale Co., The, Nicetown, Philadelphia, Pa.
Union Drawn Steel Div. Republic Steel Corp., Massillon, O.

CRAYONS (Metal Marking)
American Crayon Co., Sandusky, O.
Helmer-Staley, Inc., 327 W. Huron St., Chicago, Ill.

CRUSHERS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Pulverizer Co., 1539 Macklind Ave., St. Louis, Mo.
Diamond Iron Works, Inc., Minneapolis, Minn.
Gruendler Crusher & Pulverizer Co., 2920-28 N. Market St., St. Louis, Mo.

CUSHIONS (Pneumatic)
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.

CUTTERS (Die Sinking & End Milling)
Brown & Sharpe Mfg. Co., Providence, R. I.
Davis Keyseater Co., 390 Exchange St., Rochester, N. Y.
Tomkins-Johnson Co., The, Dept. S, 611 N. Mechanic St., Jackson, Mich.

CUTTERS (Gang Slitter)
Cowles Tool Co., 2086 W. 110 St., Cleveland, O.

CUTTERS (Thread Milling)
Detroit Tap & Tool Co., 8432 Butler St., Detroit, Mich.

CUTTING AND WELDING—See WELDING

CUTTING OILS—See OILS (Cutting)

CUTTING-OFF MACHINES (Abrasive)
Campbell, Andrew C., Div., American Chain & Cable Co., Inc., Bridgeport, Conn.
DeSanno, A. P., & Son Inc., 436 Wheatland St., Phoenixville, Pa.
Landis Machine Co., Waynesboro, Pa.

CUTTING-OFF MACHINES (Rotary)
Consolidated Machine Tool Corp., Winton & Blossom Rds., Rochester, N. Y.
Motch & Merryweather Machinery Co., Penton Bldg., Cleveland, O.
Taylor-Wilson Mfg. Co., 1200 Thomson Ave., McKees Rocks, Pa.
Yoder Co., The, W. 55th & Walworth Ave., Cleveland, O.

CYANIDING
Lakeside Steel Improvement Co., The, 5418 Lakeside Ave., Cleveland, O.

CYLINDERS (Air or Hydraulic)
American Hollow Boring Co., 1054 W. 20th St., Erie, Pa.
Anker-Holth Mfg. Co.—Airgrip Chuck Div., 332 S. Michigan Ave., Chicago, Ill.
Curtis Pneumatic Machinery Div. of Curtis Mfg. Co., 1906 Kienlen Ave., St. Louis, Mo.
Galland-Henning Mfg. Co., 2747 S. 31st St., Milwaukee, Wis.
Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill.
Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago, Ill.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Scaife Co., Ann St., Oakmont, Pa.
Tomkins-Johnson Co., The, Dept. S, 611 N. Mechanic St., Jackson, Mich.
Weatherhead Co., The, 300 E. 131st St., Cleveland, O.

CYLINDERS (Pressure)
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Midvale Co., The, Nicetown, Philadelphia, Pa.
National Tube Co., Frick Bldg., Pittsburgh, Pa.
Pressed Steel Tank Co., 1461 S. 66th St., Milwaukee, Wis.
Scaife Co., Ann St., Oakmont, Pa.

DEGREASERS
Detroit Rex Products Co., 13029 Hillview Ave., Detroit, Mich.
Magnus Chemical Co., Inc., 206 South Ave., Garwood, N. J.
Pennsylvania Salt Mfg. Co., Dept. S, Pennsalt Cleaner Div., Philadelphia, Pa.
Salem Engineering Co., 714 S. Broadway, Salem, O.

DEMAGNETIZERS
Blanchard Machine Co., The, 64 State St., Cambridge, Mass.

DEOXIDIZERS
Vanadium Corp. of America, 420 Lexington Ave., New York City.

DESCALING PROCESSES AND EQUIPMENT
American Foundry Equipment Co., The, Mishawaka, Ind.
Bullard Co., The, Bridgeport, Conn.
Turco Products, Inc., 6135 S. Central Ave., Los Angeles, Calif.

DIAMONDS (Wheel Dressing)
Diamond Tool Co., 933 E. 41st St., Chicago, Ill.

DIE BLOCKS
American Shear Knife Co., P.O. Box 355, Homestead, Pa.
Ampco Metal, Inc., Dept. S-1, 3830 W. Burnham St., Milwaukee, Wis.
Bissett Steel Co., The, 945 E. 67th St., Cleveland, O.
Firth-Sterling Steel Company, McKeesport, Pa.
Heppenstall Co., Box S-12, 4620 Hatfield St., Pittsburgh, Pa.
Kropp Forge Co., 5301 W. Roosevelt Rd., Chicago, Ill.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.

DIE CASTINGS
Titan Metal Mfg. Co., Bellefonte, Pa.

DIE CENTERS
Firth-Sterling Steel Company, McKeesport, Pa.
McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.

DIE CUSHIONS
Dayton-Rogers Mfg. Co., Dept. C., 2830 13th Ave. So., Minneapolis, Minn.

DIE HANDLING EQUIPMENT (Lifters)
Economy Engineering Co., 2657 W. Van Buren St., Chicago, Ill.

DIE HEADS
Consolidated Machine Tool Corp., Winton & Blossom Rds., Rochester, N. Y.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., The, 170 E. 131st St., Cleveland, O.
Oster Mfg. Co., The, 2037 E. 61st St., Cleveland, O.

DIE-SINKING MACHINES
Cincinnati Milling Machine Co., Cincinnati, O.
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.,

DIES (Forging)—See FORGING DIES

DIES (Punching, Stamping, Blanking)
Columbus Die, Tool & Mach. Co., 955 Cleveland Ave., Columbus, O.
Ferracute Machine Co., Bridgeton, N. J.
Firth-Sterling Steel Co., McKeesport, Pa.
Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y.
Schnorr, C. H., & Co., 643 Railroad St., Springdale, Pa.
Sheffield Corp., The, 721 Springfield St., Dayton, O.
Spriesch Tool & Mfg. Co., 10 Howard St., Buffalo, N. Y.
Zeh & Hahnemann Co., 56 Avenue A, Newark, N. J.

DIES (Steel, Embossing)
Cunningham, M. E., Co., 172 E. Carson St., Pittsburgh, Pa.
Matthews, Jas. H., & Co., 3942 Forbes St., Pittsburgh, Pa.

DIES AND CHASERS (Threading)
Landis Machine Co., Waynesboro, Pa.

DIFFERENTIALS
Fairfield Manufacturing Co., 303 S. Earl Ave., Lafayette, Ind.

DIPPING MACHINES (Monorail)
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Cleveland Crane & Engineering Co., The, 1125 E. 283rd St., Wickliffe, O.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.

DISCS (Abrasive)
Abrasive Products Inc., S. Braintree, Mass.
Carborundum Co., The, Niagara Falls, N. Y.
Chicago Wheel & Manufacturing Co., Dept. ST, 1101 W. Monroe St., Chicago, Ill.

DOLOMITE—FLUX AND REFRACTORIES
Baker, The J. E. Co., 114 N. George St., York, Pa.
Basic Refractories, Inc., Hanna Bldg., Cleveland, O.

DOORS & SHUTTERS (Steel and Wood Rolling—Service or Fire)
Kinnear Mfg. Co., 1780-1800 Fields Ave., Columbus, O.

DRAFT GAGES (Indicating, Recording)
Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Hays Corp., The, 960 Eighth Ave., Michigan City, Ind.
Peabody Engineering Corp., 580 Fifth Ave., New York City.

DRAGLINES (Crawler)
Northwest Engineering Co., 28 E. Jackson Blvd., Chicago, Ill.

DRAW BENCHES
Aetna-Standard Engineering Co., The, Home Savings Bank Bldg., Youngstown, O.
McKay Machine Co., Youngstown, O.
Standard Machinery Co., Providence, R. I.
Vaughn Machinery Co., Cuyahoga Falls, O.

DRESSERS (Grinding Wheel)
Carborundum Co., The, Niagara Falls, N. Y.
Chicago Wheel & Manufacturing Co., Dept. ST, 1101 W. Monroe St., Chicago, Ill.
Diamond Tool Co., 933 E. 41st St., Chicago, Ill.

DRILL HEADS
Michigan Industrial Sales Co., 132 Duffield St., Detroit, Mich.

DRILL HEADS (Multiple)
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, Mich.

DRILL RODS—See RODS (Drill)

DRILLING MACHINERY
Baker Bros., Inc., Post & Westlake Sts., Toledo, O.
Guibert Steel Co., 1716 Youghiogheny Ave., McKees Rocks, Pa.

DRILLING MACHINES (Radial)
Cincinnati Bickford Tool Co., The, Oakley, Cincinnati, O.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.
Walker-Turner Co., Inc., 5013 Berckman St., Plainfield, N. J.

DRILLING MACHINES (Vertical)
Baker Bros., Inc., Post & Westlake Sts., Toledo, O.
Barnes, W. F. and John, Co., Rockford, Ill.
Bryant Machinery & Engineering Co., 400 W. Madison St., Chicago, Ill.
Cleereman Machine Tool Co., Green Bay, Wis.
Consolidated Machine Tool Corp., Winton & Blossom Rds., Rochester, N. Y.
Walker-Turner Co., Inc., 5013 Berckman St., Plainfield, N. J.

DRILLS (Electric Portable)
Chicago Wheel & Manufacturing Co., Dept. ST, 1101 W. Monroe St., Chicago, Ill.
Graybar Electric Co., 420 Lexington Ave., New York City

DRILLS (Twist)—See TWIST DRILLS

DRIVES (Chain)

Link-Belt Co., 220 S. Belmont Ave., Indianapolis, Ind.
Simonds Gear & Mfg. Co., The, 25th St., Pittsburgh, Pa.

DRIVES (Cut Herringbone Gear)

Foote Bros. Gear & Machine Co., 5301 S. Western Blvd., Chicago, Ill.
Horsburgh & Scott Co., The, 5112 Hamilton Ave., Cleveland, O.
James, D. O., Mfg. Co., 1140 W. Monroe St., Chicago, Ill.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia, Pa.
Mackintosh-Hemphill Co., 9th and Bingham Sts., Pittsburgh, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Philadelphia Gear Works, Erie Ave. & G Sts., Philadelphia, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.
Westinghouse Electric & Mfg. Co., 200 McCandless Ave., Pittsburgh, Pa.

DRIVES (Multi-V-Belt)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Dodge Manufacturing Corp., Mishawaka, Ind.
Manheim Belting & Mfg. Co., Manheim, Pa.
Worthington Pump & Machinery Corp., Harrison, N. J.

DRUMS (Steel)

Pressed Steel Tank Co., 1461 S. 66th St., Milwaukee, Wis.

DRY CLEANING EQUIPMENT

Detroit Rex Products Co., 13029 Hillview Ave., Detroit, Mich.

DRYERS (Compressed Air)

Ruemelin Mfg. Co., 3882 N. Palmer St., Milwaukee, Wis.
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.

DRYERS (Paint, Varnish, Enamel, Chemical)

Maehler, Paul, Co., The, 2208 W. Lake St., Chicago, Ill.
Struthers Wells Corp., Titusville, Pa.

DRYERS AND COOLERS (Rotary)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Salem Engineering Co., 714 S. Broadway, Salem, O.

DUCTS (Acid Fume, Rubber Lined)

American Hard Rubber Co., 11 Mercer St., New York City.
Johns-Manville Corp., 22 E. 40th St., New York City

DUST ARRESTING EQUIPMENT

American Air Filter Co., 443 Central Ave., Louisville, Ky.
American Foundry Equipment Co., The, 509 S. Byrkit St., Mishawaka, Ind.
Bartlett, C. O., & Snow Co., 6300 Harvard Ave., Cleveland, O.
Pangborn Corp., Hagerstown, Md.
Peabody Engineering Corp., 580 Fifth Ave., New York City.
Ruemelin Mfg. Co., 3882 N. Palmer St., Milwaukee, Wis.
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.
Westinghouse Electric & Mfg. Co., 1216 W. 58th St., Cleveland, O.

ECONOMIZERS

Babcock & Wilcox Co., The, 85 Liberty St., New York City.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.

ELECTRIC WELDING—See WELDING

ELECTRICAL EQUIPMENT

Allen-Bradley Co., 1320 S. Second St., Milwaukee, Wis.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.
Electric Controller & Mfg. Co., The, 2700 E. 79th St., Cleveland, O.
Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.
General Electric Co., Sec. H, 750-159, Schenectady, N. Y.
Graybar Electric Co., 420 Lexington Ave., New York City.
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.
Ward Leonard Electric Co., Mt. Vernon, N. Y.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

ELECTRODES (Carbon and Graphite)

National Carbon Co., Inc., Electrode Sales Div., 30 E. 42nd St., New York City.

ELECTRODES (Hard Surfacing Welding)

General Electric Co., Sec. H, 750-159, Schenectady, N. Y.
Page Steel & Wire Div., American Chain & Cable Co., Inc., Monessen, Pa.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

ELECTRODES (Resistance Welding)

Mallory, P. R., & Co., 3029 E. Washington Ave., Indianapolis, Ind.
National Carbon Co., W. 117th St. & Madison Ave., Cleveland, O.

ELEVATING AND CONVEYING MACHINERY—See CONVEYORS

ENGINEERS AND CONTRACTORS

Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
Hydropress, Inc., 570 Lexington Ave., New York City.
McKee, Arthur G., & Co., 2300 Chester Ave., Cleveland, O.
Morgan Engineering Co., The, Alliance, O.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh, Pa.
Pollock, Wm. B. Co., The, 101 Andrews Ave., Youngstown, O.
Pritchard, J. F. & Co., Dwight Bldg., Kansas City, Mo.
Wean Engineering Co., Warren, O.

ENGINEERS (Consulting)

Aetna-Standard Engineering Co., The, Home Savings Bank Bldg., Youngstown, O.
Easton Car & Construction Co., Easton, Pa.
Freyn Engineering Co., 310 S. Michigan Ave., Chicago, Ill.
Garrett, George K., Co., D & Tioga Sts., Philadelphia, Pa.
Hepburn American Co., Maher Bldg., Greenwich, Conn.
Koppers Co., Engineering and Construction Div., 901 Koppers Bldg., Pittsburgh, Pa.
McKee, Arthur G., & Co., 2300 Chester Ave., Cleveland, O.
Wean Engineering Co., Warren, O.

ENGINES (Diesel)

Buda Co., The, Harvey, Ill.
Cooper-Bessemer Corp., The, Mt. Vernon, O.
Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.
Worthington Pump & Machinery Corp., Harrison, N. J.

ENGINES (Gas, Oil)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Buda Co., The, Harvey, Ill.
Cooper-Bessemer Corp., The, Mt. Vernon, O.
Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Wisconsin Motor Corp., Milwaukee, Wis.
Worthington Pump & Machinery Corp., Harrison, N. J.

ENGINES (Kerosene)

Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.

ENGINES (Steam)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Oil Well Supply Co., Dallas, Texas.
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.

EVAPORATORS

Struthers Wells Corp., Titusville, Pa.

EXCAVATORS

Osgood Co., The, Marion, O.
Northwest Engineering Co., 28 E. Jackson Blvd., Chicago, Ill.

FABRICATION (All Types)

Doyle, The, J. E., Co., 1220 West 6th St., Cleveland, O.

FABRICATORS (Structural)

Guibert Steel Co., 1716 Youghiogheny Ave., McKees Rocks, Pa.

FANS (Crane Cab)

Graybar Electric Co., 420 Lexington Ave., New York City.
Perkins, B. F., & Son, Inc., Holyoke, Mass.

FANS (Exhaust Ventilating)

General Electric Co., Bridgeport, Conn.
Graybar Electric Co., 420 Lexington Ave., New York City.
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.

FANS (Mechanical Draft)

Sturtevant, B. F., Co., Hyde Park, Boston, Mass.

FANS (Portable)

Graybar Electric Co., 420 Lexington Ave., New York City.
Perkins, B. F., & Son, Inc., Holyoke, Mass.

FANS (Wall)

Graybar Electric Co., 420 Lexington Ave., New York City.
Perkins, B. F., & Son, Inc., Holyoke, Mass.

FENCE (Chain Link)

Continental Steel Corp., Kokomo, Ind.
Cyclone Fence Div., American Steel & Wire Co., Waukegan, Ill.
Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.

FENCING (Wire)

American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.
Republic Steel Corp., E. 45th & Broadway, Cleveland, Ohio.
Roebling's, John A., Sons Co., Trenton, N. J.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.

FERROALLOY BRIQUETS

Electro Metallurgical Co., 30 E. 42nd St., New York City.

FERROALLOYS

Cleveland-Cliffs Iron Co., The, Union Commerce Bldg., Cleveland, O.
Electro Metallurgical Co., 30 E. 42nd St., New York City.
International Nickel Co., Inc., The, 67 Wall St., New York City.
Metal & Thermit Corp., 120 Broadway, New York City.
Titanium Alloy Mfg. Co., The, Niagara Falls, N. Y.
Vanadium Corp. of America, 420 Lexington Ave., New York City.

FERRO BORON

Molybdenum Corp. of America, Grant Bldg., Pittsburgh, Pa.

FERROCHROME

Electro Metallurgical Co., 30 E. 42nd St., New York City.
Samuel, Frank, & Co., Inc., Harrison Bldg., Philadelphia, Pa.
Vanadium Corp. of America, 420 Lexington Ave., New York City.

FERROMANGANESE

Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., 327 Carnegie Bldg., Pittsburgh, Pa.
Electro Metallurgical Co., 30 E. 42nd St., New York City.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Samuel, Frank & Co., Inc., Harrison Bldg., Philadelphia, Pa.

FERRO MOLYBDENUM

Molybdenum Corp. of America, Grant Bldg., Pittsburgh, Pa.

FERROPHOSPHORUS

Samuel, Frank & Co., Inc., Harrison Bldg., Philadelphia, Pa.

FERROSILICON

Electro Metallurgical Co., 30 E. 42nd St., New York City.
Samuel, Frank, & Co., Inc., Harrison Bldg., Philadelphia, Pa.
Southern Ferro Alloys Co., 2108 Chestnut St., Chattanooga, Tenn.
Vanadium Corp. of America, 420 Lexington Ave., New York City.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

FERROSILICON ALUMINUM

Vanadium Corp. of America, 420 Lexington Ave., New York City.

FERROTITANIUM

Metal & Thermit Corp., 120 Broadway, New York City.
Titanium Alloy Mfg. Co., The, Niagara Falls, N. Y.
Vanadium Corp. of America, 420 Lexington Ave., New York City.

FERRO TUNGSTEN

Molybdenum Corp. of America, Grant Bldg., Pittsburgh, Pa.

FERROVANADIUM

Electro Metallurgical Sales Corp., 30 E. 42nd St., New York City.
Vanadium Corp. of America, 420 Lexington Ave., New York City.

FILES AND RASPS

Atkins, E. C., & Co., 427 S. Illinois St., Indianapolis, Ind.
Disston, Henry, & Sons, Inc., 1226 Tacony, Philadelphia, Pa.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FINISH, BLACK OXIDE (Chemicals for)

Alrose Chemical Co., 180 Mill St., Providence, R. I.

FIRE BRICK—See BRICK

FIRE BRICK (Insulating)

Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.
Johns-Manville Corp., 22 E. 40th St., New York City

FIRE CLAY—See REFRACTORIES

FIRE DOORS & SHUTTERS—See DOORS & SHUTTERS

FIRE EXTINGUISHERS

Cardox Corp., 307 N. Michigan Ave., Chicago, Ill.
Kidde, Walter, & Co., Inc., 932 West St., Bloomfield, N. J.

FIRE EXTINGUISHING SYSTEMS

Cardox Corp., 307 N. Michigan Ave., Chicago, Ill.
Kidde, Walter, & Co., Inc., 932 West St., Bloomfield, N. J.

FIRE PROTECTION EQUIPMENT
Cardox Corp., 307 N. Michigan Ave., Chicago, Ill.
Kidde, Walter, & Co., Inc., 932 West St., Bloomfield, N. J.

FITTINGS (Malleable and Cast Iron)
Crane Co., 836 S. Michigan Ave., Chicago, Ill.
Flori Pipe Co., The, Red Bud and Bulwer Ave., St. Louis, Mo.

FITTINGS (Rubber Lined)
American Hard Rubber Co., 11 Mercer St., New York City.

FIXTURES (Fluorescent Lighting)
Guth, Edwin F., Co., The, 2615 Washington Ave., St. Louis, Mo.

FLAME HARDENING
Air Reduction, 60 E. 42nd St., New York City.
Linde Air Products Co., 30 E. 42nd St., New York City.
National-Erie Corp., Erie, Pa.

FLANGES (Forged Steel)
Crane Co., 836 S. Michigan Ave., Chicago, Ill.
Flori Pipe Co., The, Red Bud and Bulwer Ave., St. Louis, Mo.
Kropp Forge Co., 5301 W. Roosevelt Rd., Chicago, Ill.
Phoenix Mfg. Co., Joliet, Ill.

FLANGES (Welded Steel)
Flori Pipe Co., The, Red Bud and Bulwer Ave., St. Louis, Mo.
King Fifth Wheel Co., 2915 N. Second St., Philadelphia, Pa.

FLOOD LIGHTS
Pittsburgh Reflector Co., Oliver Bldg., Pittsburgh, Pa.

FLOORING (Monolithic)
Carey, Philip, Mfg. Co., The, Lockland, Cincinnati, O.
Johns-Manville Corp., 22 E. 40th St., New York City.

FLOORING (Steel)
Alan Wood Steel Co., Conshohocken, Pa.
Blaw-Knox Co., Blawnox, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Dravo Corp. (Machinery Div.), 500 Penn Ave., Pittsburgh, Pa.
Hendrick Mfg. Co., Carbondale, Pa.
Howard Foundry Co., 4918 Bloomingdale Ave., Chicago, Ill.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Republic Steel Corp., Dept. ST, Cleveland, O.
Robertson, H. H., Co., Farmers Bank Bldg., Pittsburgh, Pa.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Scully Steel Products Co., 1316 Wabansia Ave., Chicago, Ill.
Tri-Lok Co., 5515 Butler St., Pittsburgh, Pa.

FLUE DUST CONDITIONERS
Brosius, Edgar E., Co., Sharpsburg Branch, Pittsburgh, Pa.

FLUE GAS ANALYZERS
Hays Corp., The, 960 Eighth Ave., Michigan City, Ind.
Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.

FLUORSPAR
Samuel, Frank, & Co., Inc., Harrison Bldg., Philadelphia, Pa.

FLUXES (Soldering, Welding & Tinning)
American Chemical Paint Co., Dept. 310, Ambler, Pa.
Eutectic Welding Alloys, Inc., 40 Worth St., New York City
Kester Solder Co., 4222 Wrightwood Ave., Chicago, Ill.
Linde Air Products Co., The, 30 E. 42nd St., New York City.

FORGING BILLETS—See BILLETS (Forging)

FORGING DIES
Kropp Forge Co., 5301 W. Roosevelt, Rd., Chicago, Ill.

FORGING MACHINERY
Alliance Machine Co., The, Alliance, O.
Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia, Pa.
Erie Foundry Co., Erie, Pa.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Industrial Brownhoist Corp., Bay City, Mich.
Morgan Engineering Co., The, Alliance, O.
National Machinery Co., The, Tiffin, O.

FORGINGS (Aluminum, Brass, Bronze, Copper)
Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh, Pa.
American Brass Co., The, Waterbury, Conn.
Ampco Metal, Inc., Dept. S-1, 3830 W. Burnham St., Milwaukee, Wis.
Titan Metal Mfg. Co., Bellefonte, Pa.
Williams, J. H., & Co., 400 Vulcan St., Buffalo, N. Y.

FORGINGS (Drop) (*Also Stainless)
*Atlas Drop Forge Co., Lansing, Mich.
*Bethlehem Steel Co., Bethlehem, Pa.
Davenport-Besler Corp., Davenport, Iowa
Kropp Forge Co., 5301 W. Roosevelt Rd., Chicago, Ill.
Ladish Drop Forge Co., Cudahy, Wis.
Oil Well Supply Co., Dallas, Texas.
Phoenix Manufacturing Co., Joliet, Ill.

FORGINGS (Hollow Bored)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Hollow Boring Co., 1054 W. 20th St., Erie, Pa.
Atlas Drop Forge Co., Lansing, Mich.
Bay City Forge Co., W. 19th and Cranberry Sts., Erie, Pa.
Erie Forge Co., W. 15th & Cascade Sts., Erie, Pa.
Kropp Forge Co., 5301 W. Roosevelt Rd., Chicago, Ill.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Midvale Co., The, Nicetown, Philadelphia, Pa.
Phoenix Manufacturing Co., Joliet, Ill.

FORGINGS (Iron and Steel) (*Also Stainless)
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*Atlas Drop Forge Co., Lansing, Mich.
*Barium Stainless Steel Corp., Canton, O.
Bay City Forge Co., W. 19th and Cranberry Sts., Erie, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Dyson, Jos., & Sons, Inc., 1133 West 9th St., Cleveland, O.
Erie Forge Co., W. 15th & Cascade Sts., Erie, Pa.
Heppenstall Co., Box S-12, 4620 Hatfield St., Pittsburgh, Pa.
*Kropp Forge Co., 5301 W. Roosevelt Rd., Chicago, Ill.
Ladish Drop Forge Co., Cudahy, Wis.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
*Midvale Co., The, Nicetown, Philadelphia, Pa.
Oil Well Supply Co., Dallas, Texas.
Oliver Iron & Steel Corp., S. 10th & Muriel Sts., Pittsburgh, Pa.
Phoenix Manufacturing Co., Joliet, Ill.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.
Struthers Wells Corp., Titusville, Pa.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Williams, J. H., & Co., 400 Vulcan St., Buffalo, N. Y.

FORGINGS (Machined)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Kropp Forge Co., 5301 W. Roosevelt Rd., Chicago, Ill.

FORGINGS (Small)
Kropp Forge Co., 5301 W. Roosevelt Rd., Chicago, Ill.
Phoenix Manufacturing Co., Joliet, Ill.

FORGINGS (Upset)
American Metal Products Co., 5959 Linsdale Ave., Detroit, Mich.
Atlas Drop Forge Co., Lansing, Mich.
Bethlehem Steel Co., Bethlehem, Pa.
Kropp Forge Co., 5301 W. Roosevelt Rd., Chicago, Ill.
Phoenix Manufacturing Co., Joliet, Ill.
Standard Tube Co., The, 14600 Woodward Ave., Detroit, Mich.

FOUNDRY EQUIPMENT
American Foundry Equipment Co., The, 500 S. Byrkit St., Mishawaka, Ind.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Mahr Mfg. Co., 1702 N. Second St., Minneapolis, Minn.
Pangborn Corporation, Hagerstown, Md.
Ransohoff, N., Inc., 1317 Township Ave., Cincinnati, O.
Vapor Blast Mfg. Co., 333 S. 16th St., Milwaukee, Wis.

FOUNDRY SUPPLIES
Acheson Colloids Corp., Port Huron, Mich.

FROGS AND SWITCHES
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

FURNACE INSULATION—See INSULATION

FURNACES (Blast)
Freyn Engineering Co., 310 S. Michigan Ave., Chicago, Ill.
McKee, Arthur G., & Co., 2300 Chester Ave., Cleveland, O.
Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.

FURNACES (Brazing)
Bellis Heat Treating Co., Branford, Conn.
Electric Furnace Co., The, Salem, O.
Firth-Sterling Steel Co., McKeesport, Pa.
General Electric Co., Sec. H, 750-159, Schenectady, N. Y.
Hevi Duty Electric Co., 4212 W. Highland Blvd., Milwaukee, Wis.
Lepel High Frequency Laboratories, Inc., 39 W. 60th St., New York City
Salem Engineering Co., 714 S. Broadway, Salem, O.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

FURNACES (Electric Heating)
Ajax Electrothermic Corp., Ajax Park, Trenton, N. J.
Bellis Heat Treating Co., Branford, Conn.
Drever Company, The, 780 Venango St., Philadelphia, Pa.
Electric Furnace Co., The, Salem, O.
General Electric Co., Sec. H, 750-159, Schenectady, N. Y.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Hevi Duty Electric Co., 4212 W. Highland Blvd., Milwaukee, Wis.
Hydro-Arc Furnace Corp., 561 Hillgrove Ave., LaGrange, Ill.
Lepel High Frequency Laboratories, Inc., 39 W. 60th St., New York City
Mahr Mfg. Co., 1702 N. Second St., Minneapolis, Minn.
Pittsburgh Lectromelt Furnace Corp., P. O. Box 1257, Pittsburgh, Pa.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

FURNACES (Electric Melting)
Ajax Electrothermic Corp., Ajax Park, Trenton, N. J.
American Bridge Co., Frick Bldg., Pittsburgh, Pa.
Detroit Electric Furnace Div., Kuhlman Electric Co., Bay City, Mich.
Hydro-Arc Furnace Corp., 561 Hillgrove Ave., LaGrange, Ill.
Lepel High Frequency Laboratories, Inc., 39 W. 60th St., New York City
Pittsburgh Lectromelt Furnace Corp., P. O. Box 1257, Pittsburgh, Pa.
Swindell-Dressler Corp., P. O. Box 1888, Pittsburgh, Pa.

FURNACES (Enameling)
Electric Furnace Co., The, Salem, O.
General Electric Co., Sec. H, 750-159, Schenectady, N. Y.
Hagan, George J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Maehler, Paul, Co., The, 2208 W. Lake St., Chicago, Ill.

FURNACES (Forging)
Ajax Electrothermic Corp., Ajax Park, Trenton, N. J.
Amsler-Morton Co., The, Fulton Bldg., Pittsburgh, Pa.
Bellis Heat Treating Co., Branford, Conn.
Drever Co., The, 730 E. Venango St., Philadelphia, Pa.
Electric Furnace Co., The, Salem, O.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Lepel High Frequency Laboratories, Inc., 39 W. 60th St., New York City
Mahr Mfg. Co., 1702 N. Second St., Minneapolis, Minn.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh, Pa.
R-S Products Corp., 123 Berkley St., Philadelphia, Pa.
Salem Engineering Co., 714 So. Broadway, Salem, O.
Surface Combustion Div. of General Properties Co., Inc., 2375 Dorr St., Toledo, O.
Swindell-Dressler Corp., P. O. Box 1888, Pittsburgh, Pa.
Wilson, Lee, Engineering Co., 20005 Lake Rd., Cleveland, O.

FURNACES (Galvanizing)
General Electric Co., Sec. H, 750-159, Schenectady, N. Y.
Mahr Mfg. Co., 1702 N. Second St., Minneapolis, Minn.
Salem Engineering Co., 714 So. Broadway, Salem, O.

FURNACES (Gas or Oil)
Drever Co., The, 730 E. Venango St., Philadelphia, Pa.
Electric Furnace Co., The, Salem, O.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Harvey Furnace Co., The, 2935 St. Paul St., Baltimore, Md.
Johnson Gas Appliance Co., 591 "E" Ave., N.W., Cedar Rapids, Iowa
Mahr Mfg. Co., 1702 N. Second St., Minneapolis, Minn.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh, Pa.
R-S Products Corp., 123 Berkeley St., Philadelphia, Pa.
Salem Engineering Co., 714 So. Broadway, Salem, O.
Surface Combustion Div. of General Properties Co., Inc., 2375 Dorr St., Toledo, O.
Swindell-Dressler Corp., P. O. Box 1888, Pittsburgh, Pa.

FURNACES (Heat Treating, Annealing, Carburizing, Hardening, Tempering)

Ajax Electrothermic Corp., Ajax Park, Trenton, N. J.
American Gas Furnace Co., Elizabeth, N. J.
Amsler-Morton Co., The, Fulton Bldg., Pittsburgh, Pa.
Bellis Heat Treating Co., Branford, Conn.
Despatch Oven Co., 722 Central Ave., Minneapolis, Minn.
Drever Co., The, 730 E. Venango St., Philadelphia, Pa.
Electric Furnace Co., The, Salem, O.
General Electric Co., Sec. H, 750-159, Schenectady, N. Y.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Hevi Duty Electric Co., 4212 W. Highland Blvd., Milwaukee, Wis.
Holden, A. F., Co., The, 200 Winchester Ave., New Haven, Conn.
Johnson Gas Appliance Co., 591 "E" Ave., N.W., Cedar Rapids, Iowa
Kemp, C. M., Mfg. Co., 405 E. Oliver St., Baltimore, Md.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia, Pa.
Lepel High Frequency Laboratories, Inc., 39 W. 60th St., New York City
Machler, Paul. Co., The, 2208 W. Lake St., Chicago, Ill.
Mahr Mfg. Co., 1702 N. Second St., Minneapolis, Minn.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh, Pa.
R-S Products Corp., 132 Berkley St., Philadelphia, Pa.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Surface Combustion Div. of General Properties Co., Inc., 2375 Dorr St., Toledo, O.
Swindell-Dressler Corp., P. O. Box 1888, Pittsburgh, Pa.
Wean Engineering Co., Warren, O.
Wellman Engineering Co., The 7000 Central Ave., Cleveland, O.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.
Wilson, Lee, Engineering Co., 20005 Lake Rd., Cleveland, O.

FURNACES (Laboratory)

Ajax Electrothermic Corp., Ajax Park, Trenton, N. J.
Dietert, Harry W., Co., 9330J Roselawn Ave., Detroit, Mich.
Drever Co., The, 730 Venango St., Philadelphia, Pa.
Hevi Duty Electric Co., 4212 W. Highland Blvd., Milwaukee, Wis.
Johnson Gas Appliance Co., 591 "E" Ave., N.W., Cedar Rapids, Iowa
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia, Pa.
Lepel High Frequency Laboratories, Inc., 39 W. 60th St., New York City
Mahr Mfg. Co., 1702 N. Second St., Minneapolis, Minn.

FURNACES (Nonferrous Melting)

Ajax Electrothermic Corp., Ajax Park, Trenton, N. J.
Detroit Electric Furnace Div., Kuhlman Electric Co., Bay City, Mich.
Lepel High Frequency Laboratories, Inc., 39 W. 60th St., New York City
Salem Engineering Co., 714 S. Broadway, Salem, O.

FURNACES (Open Hearth)

Amsler-Morton Co., The, Fulton Bldg., Pittsburgh, Pa.
McKee, Arthur G., & Co., 2300 Chester Ave., Cleveland, O.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Swindell-Dressler Corp., P. O. Box 1888, Pittsburgh, Pa.

FURNACES (Portable)

Hagan, George J., Co., 2400 E. Carson St., Pittsburgh, Pa.

FURNACES (Recuperative)

Amsler-Morton Co., The, Fulton Bldg., Pittsburgh, Pa.
Electric Furnace Co., The, Salem, O.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Surface Combustion Div. of General Properties Co., Inc., 2375 Dorr St., Toledo, O.
Swindell-Dressler Corp., P. O. Box 1888, Pittsburgh, Pa.

FURNACES (Rivet Heating)

Ajax Electrothermic Corp., Ajax Park, Trenton, N. J.
Drever Co., The, 780 Venango St., Philadelphia, Pa.
Lepel High Frequency Laboratories, Inc., 39 W. 60th St., New York City
Mahr Mfg. Co., 1702 N. Second St., Minneapolis, Minn.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Surface Combustion Div. of General Properties Co., Inc., 2375 Dorr St., Toledo, O.

FURNACES (Sheet and Tin Mill)

Amsler-Morton Co., The, Fulton Bldg., Pittsburgh, Pa.
Electric Furnace Co., Salem, O.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Kemp, C. M., Mfg. Co., 405 E. Oliver St., Baltimore, Md.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh, Pa.
Salem Engineering Co., 714 So. Broadway, Salem, O.
Surface Combustion Div. of General Properties Co., Inc., 2375 Dorr St., Toledo, O.
Swindell-Dressler Corp., P. O. Box 1888, Pittsburgh, Pa.
Wean Engineering Co., Warren, O.
Wilson, Lee, Engineering Co., 20005 Lake Rd., Cleveland, O.

FURNACES (Steel Mill)

Ajax Electrothermic Corp., Ajax Park, Trenton, N. J.
Amsler-Morton Co., The, Fulton Bldg., Pittsburgh, Pa.
Electric Furnace Co., Salem, O.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Kemp, C. M., Mfg. Co., 405 E. Oliver St., Baltimore, Md.
Pennsylvania Industrial Engineers, 2413 W Magnolia St., Pittsburgh, Pa.
Salem Engineering Co., 714 So. Broadway, Salem, O.
Surface Combustion Div. of General Properties Co., Inc., 2375 Dorr St., Toledo, O.
Swindell-Dressler Corp., P. O. Box 1888, Pittsburgh, Pa.
Wilson, Lee, Engineering Co., 20005 Lake Rd., Cleveland, O.

FURNACES (Welding)

Hagan, George J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Mahr Mfg. Co., 1702 N. Second St., Minneapolis, Minn.

GAGE BLOCKS

Continental Machines, Inc., 1324 S. Washington Ave., Minneapolis, Minn.

GAGES

Agerstrand Corp., Muskegon, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Firth-Sterling Steel Co., McKeesport, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.
Scherr, George, Co., 126 Lafayette St., New York City
Schnorr, C. H., & Co., 643 Railroad St., Springdale, Pa.
Sheffield Corp., The, 721 Springfield St., Dayton, O.
Trico Products Corp., 97 Burton St., Buffalo, N. Y.
Turner Gage Grinding Co., 2630 Hilton Rd., Ferndale, Mich.
Woodworth, N. A., Co., 1241 Wanda Ave., Ferndale, Mich.

GAGES (Automatic Control & Recording)

Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Foxboro Co., The, Foxboro, Mass.
Hays Corp., The, Michigan City, Ind.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia, Pa.
Sheffield Corp., The, 721 Springfield St., Dayton, O.

GAGES (Indicating and Recording)

Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Foxboro Co., The, Foxboro, Mass.
General Electric Co., Sec. H, 750-159, Schenectady, N. Y.
Hays Corp., The, Michigan City, Ind.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia, Pa.
Sheffield Corp., The, 721 Springfield St., Dayton, O.
Westinghouse Electric & Mfg. Co., Orange Ave., Newark, N. J.

GAGES (Pressure & Vacuum Recording)

Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Foxboro Co., The, Foxboro, Mass.
Hays Corp., The, Michigan City, Ind.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia, Pa.

GAGES (Thread-Ring & Plug)

Detroit Tap & Tool Co., 8432 Butler St., Detroit, Mich.
Sheffield Corp., The, 721 Springfield St., Dayton, O.
Turner Gage Grinding Co., 2630 Hilton Rd., Ferndale, Mich.

GALVANIZING (Hot Dip)

Acme Galvanizing, Inc., Milwaukee, Wis.
Acme Steel & Malleable Iron Works, Buffalo, N. Y.
American Hot Dip Galvanizers Assoc., Inc., American Bank Bldg., Pittsburgh, Pa.
American Tinning & Galvanizing Co., Erie, Pa.
Atlantic Stamping Co., Rochester, N. Y.
Atlantic Steel Co., Atlanta, Ga.
Buffalo Galvanizing & Tinning Works, Inc., Buffalo, N. Y.
Cattie, Jos. P., & Bros., Gaul and Liberty Sts., Philadelphia, Pa.
Commercial Metals Treating, Inc., Toledo, Ohio
Diamond Expansion Bolt Co., Inc., Garwood, N. J.
Enterprise Galvanizing Co., 2525 E. Cumberland St., Philadelphia, Pa.
Equipment Steel Products Div. of Union Asbestos and Rubber Co., Blue Island, Ill.
Fanner Mfg. Co., The, Cleveland, O.
Finn, John, Metal Works, San Francisco, Calif.
Galvanizers Incorporated, Portland, Ore.
Gregory, Thomas, Galvanizing Works, Maspeth, N. Y.
Hanlon-Gregory Galvanizing Co., 5515 Butler St., Pittsburgh, Pa.
Hill, James Mfg. Co., Providence, R. I.
Hubbard & Co., Oakland, Calif.
Independent Galvanizing Co., Newark, N. J.
International-Stacey Corp., Columbus, O.
Isaacson Iron Works, Seattle, Wash.
Joslyn Co. of California, Los Angeles, Calif.
Joslyn Mfg. & Supply Co., Chicago, Ill.
Koven, L. O., & Bro., Inc., Jersey City, N. J.
Thomas Laughlin Co., Portland, Maine
Lehigh Structural Steel Co., Allentown, Pa.
Lewis Bolt & Nut Co., Minneapolis, Minn.
Missouri Rolling Mill Corp., St. Louis, Mo.
National Telephone Supply Co., The, Cleveland, O.
Oliver Iron & Steel Corp., S. 10th & Muriel Sts., Pittsburgh, Pa.
Penn Galvanizing Co., Philadelphia, Pa.
Riverside Foundry & Galvanizing Co., Kalamazoo, Mich.
San Francisco Galvanizing Works, San Francisco, Calif.
Sanitary Tinning Co., The, Cleveland, O.
Scaife Co., Ann St., Oakmont, Pa.
Southern Galvanizing Co., Baltimore, Md.
Standard Galvanizing Co., Chicago, Ill.
Wilcox, Crittenden & Co., Inc., Middletown, Conn.
Witt Cornice Co., The, Cincinnati, O.

GALVANIZING PLANTS FOR SHEETS

Aetna-Standard Engineering Co., The, Home Savings Bank Bldg., Youngstown, O.
Erie Foundry Co., Erie, Pa.
Wean Engineering Co., Warren, O.

GALVANIZING PRODUCTS

Enterprise Galvanizing Co., 2525 E. Cumberland St., Philadelphia, Pa.

GAS HOLDERS

Bartlett-Hayward Div., Koppers Co., Baltimore, Md.
Bethlehem Steel Co., Bethlehem, Pa.

GAS PRODUCER PLANTS

Koppers Co., Engineering and Construction Div., 901 Koppers Bldg., Pittsburgh, Pa.
Morgan Construction Co., Worcester, Mass.
Wellman Engineering Co., The, 7000 Central Ave., Cleveland, O.
Wood, R. D., Co., 400 Chestnut St., Philadelphia, Pa.

GAS RECOVERY COKE OVENS AND GAS PLANTS

Bartlett-Hayward Div., Koppers Co., Baltimore, Md.
Koppers Co., Engineering and Construction Div., 901 Koppers Bldg., Pittsburgh, Pa.

GAS SCRUBBERS AND WASHERS

Bartlett-Hayward Div., Koppers Co., Baltimore, Md.
McKee, Arthur G. & Co., 2300 Chester Ave., Cleveland, O.
Peabody Engineering Corp., 580 Fifth Ave., New York City.

GAS WASHERS—See GAS SCRUBBERS AND WASHERS

GASKETS (Asbestos, Metal or Rubber)

Crane Co., 836 S. Michigan Ave., Chicago, Ill.
Johns-Manville Corp., 22 E. 40th St., New York City.
National Lead Co., 111 Broadway, New York City

GEAR BLANKS

Ampco Metal, Inc., Dept. S-1, 3630 W. Burnham St., Milwaukee, Wis.
Bay City Forge Co., W. 19th and Cranberry Sts., Erie, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Foote Bros. Gear & Machine Co., 5301 S. Western Blvd., Chicago, Ill.
King Fifth Wheel Co., 2915 No. Second St., Philadelphia, Pa.
National-Erie Corp., Erie, Pa.
Philadelphia Gear Works, Erie Ave. & G St., Philadelphia, Pa.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.
Waldron, John, Corp., New Brunswick, N. J.

GEAR MACHINERY (Generating)

National Broach & Machine Co., 5600 St. Jean, Detroit, Mich.

GEAR MACHINERY (Lapping, Finishing, Checking)

Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.
Sheffield Corp., The, 721 Springfield St., Dayton, O.

GEARS (Non-Metallic)
Chicago Rawhide Mfg. Co., 1308 Elston Ave., Chicago, Ill.
General Electric Co., Sec. H, 750-159, Schenectady, N. Y.
James, D. O., Mfg. Co., 1140 W. Monroe St., Chicago, Ill.
Pittsburgh Gear & Machine Co., 2680-2700 Smallman St., Pittsburgh, Pa.
Simonds Gear & Mfg. Co., The, 25th St., Pittsburgh, Pa.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

GEARS (Steel Laminated)
Simonds Gear & Mfg. Co., The, 25th St., Pittsburgh, Pa.
Waldron, John, Corp., New Brunswick, N. J.

GEARS (Worm)
Cleveland Worm & Gear Co., 3270 E. 80th St., Cleveland, O.
Fairfield Manufacturing Co., 303 S. Earl Ave., Lafayette, Ind.
Foote Bros. Gear & Machine Co., 5301 S. Western Blvd., Chicago, Ill.
Horsburgh & Scott Co., The, 5112 Hamilton Ave., Cleveland, O.
James, D. O., Mfg. Co., 1140 W. Monroe St., Chicago, Ill.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.
Philadelphia Gear Works, Erie Ave. & G Sts., Philadelphia, Pa.
Pittsburgh Gear & Machine Co., 2680-2700 Smallman St., Pittsburgh, Pa.
Simonds Gear & Mfg. Co., The, 25th St., Pittsburgh, Pa.

GEARS AND GEAR CUTTING
Dodge Manufacturing Corp., Mishawaka, Ind.
Fairfield Manufacturing Co., 303 S. Earl Ave., Lafayette, Ind.
Foote, Brad, Gear Works, Cicero, Ill.
Foote Bros. Gear & Machine Co., 5301 S. Western Blvd., Chicago, Ill.
General Electric Co., Sec. H, 750-159, Schenectady, N. Y.
Grant Gear Works, 2nd & B Sts., Boston, Mass.
Horsburgh & Scott Co., The, 5112 Hamilton Ave., Cleveland, O.
James, D. O., Mfg. Co., 1140 W. Monroe St., Chicago, Ill.
Jones, W. A., Fdry. & Mach. Co., 4437 Roosevelt Rd., Chicago, Ill.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Mackintosh-Hemphill Co., 19th and Bingham Sts., Pittsburgh, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.
National-Erie Corp., Erie, Pa.
Philadelphia Gear Works, Erie Ave. & G St., Philadelphia, Pa.
Pittsburgh Gear & Machine Co., 2680-2700 Smallman St., Pittsburgh, Pa.
Simonds Gear & Mfg. Co., 25th St., Pittsburgh, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.
Westinghouse Electric & Mfg. Co., 200 McCandless Ave., Pittsburgh, Pa.

GENERATING SETS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Buda Co., The, Harvey, Ill.
Century Electric Co., 1806 Pine St., St. Louis, Mo.
Cooper-Bessemer Corp., The, Mt. Vernon, O.
Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.
General Electric Co., Sec. H, 750-159, Schenectady, N. Y.
Graybar Electric Co., 420 Lexington Ave., New York City
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Ready-Power Co., The, 3826 Grand River Ave., Detroit, Mich.
Reliance Electric & Eng. Co., 1088 Ivanhoe Rd., Cleveland, O.
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.
Worthington Pump & Machinery Corp., Harrison, N. J.

GENERATORS (Acetylene—Portable and Stationary)
Linde Air Products Co., The, 30 E. 42nd St., New York City.

GENERATORS (Electric)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Century Electric Co., 1806 Pine St., St. Louis, Mo.
Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.
General Electric Co., Sec. H, 750-159, Schenectady, N. Y.
Graybar Electric Co., 420 Lexington Ave., New York City
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Lincoln Electric Co., The, Cleveland, O.
Reliance Electric & Eng. Co., 1088 Ivanhoe Rd., Cleveland, O.
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.

GENERATORS (Plating)
Udylite Corp., The, 1651 E. Grand Blvd., Detroit, Mich.

GLOVES
Kimball Safety Products Co., 7314 Wade Park Ave., Cleveland, O.

GOGGLES (Safety)
Kimball Safety Products Co., 7314 Wade Park Ave., Cleveland, O.

GRABS—FOR SHEETS, COILS, INGOTS
J-B Engineering Sales Co., 3100 East St., New Haven, Conn.

GRAPHITE
Acheson Colloids Corp., Port Huron, Mich.
National Carbon Co., W. 117th St. & Madison Ave., Cleveland, O.
United States Graphite Co., The, Saginaw, Mich.

GRAPHITE (Colloidal)
Acheson Colloids Corp., Port Huron, Mich.

GRATING
Blaw-Knox Co., Blawnox, Pa.
Borden Metal Products Co., P. O. Box 172, Elizabeth, N. J.
Bravo Corp., (Machinery Div.), 300 Penn Ave., Pittsburgh, Pa.
Hendrick Mfg. Co., Carbondale, Pa.
Tri-Lok Co., 5515 Butler St., Pittsburgh, Pa.

GREASE (Lubricating)—See LUBRICANTS (Industrial)

GREASE SEALS
Chicago Rawhide Mfg. Co., 1308 Elston Ave., Chicago, Ill.

GRILLS (Perforated Metal)
Hendrick Mfg. Co., Carbondale, Pa.

GRINDER ATTACHMENTS
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders Incorporated, Cincinnati, Ohio
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Landis Machine Co., Waynesboro, Pa.
Lempco Products Inc., Dept. SS, Bedford, O.

GRINDER CENTERS
Firth-Sterling Steel Company, McKeesport, Pa.
McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.

GRINDER HEADS
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Lempco Products Inc., Dept. SS, Bedford, O.

GRINDERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders Incorporated, Cincinnati, Ohio
Heald Machine Co., Worcester, Mass.
Landis Machine Co., Waynesboro, Pa.
Lempco Products Inc., Dept. SS, Bedford, O.
Norton Co., Worcester, Mass.

GRINDERS (Bench & Floor Type)
Walker-Turner Co., Inc., 5013 Berckman St., Plainfield, N. J.

GRINDERS (Centerless—Internal and External)
Cincinnati Grinders, Incorporated, Cincinnati, O.
Heald Machine Co., Worcester, Mass.
Lempco Products Inc., Dept. SS, Bedford, O.

GRINDERS (Chucking)
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Heald Machine Co., Worcester, Mass.

GRINDERS (Circular Saw)
Motch & Merryweather Machinery Co., Penton Bldg., Cleveland, O.

GRINDERS (Crank Pin, Cam, Piston, Valve Face)
Cincinnati Grinders, Incorporated, Cincinnati, O.
Lempco Products Inc., Dept. SS, Bedford, O.
Norton Company, Worcester, Mass.

GRINDERS (Cylindrical)
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders Incorporated, Cincinnati, Ohio
Lempco Products Inc., Dept. SS, Bedford, O.
Norton Co., Worcester, Mass.

GRINDERS (Die)
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Landis Machine Co., Waynesboro, Pa.

GRINDERS (Foundry Core)
Milwaukee Foundry Equipment Co., 3238 W. Pierce St., Milwaukee, Wis.

GRINDERS (Oscillating)
Van Norman Machine Tool Co., Springfield, Mass.

GRINDERS (Plain and Universal)
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Incorporated, Cincinnati, O.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
LeBlond, R. K. Machine Tool Co., The, Dept. J-2, Cincinnati, O.
Lempco Products Inc., Dept. SS, Bedford, O.
Norton Co., Worcester, Mass.

GRINDERS (Portable)
Chicago Wheel & Manufacturing Co., Dept. ST, 1101 W. Monroe St., Chicago, Ill.
Cleveland Pneumatic Tool Co., The, 3734 E. 78th St., Cleveland, O.
Graybar Electric Co., 420 Lexington Ave., New York City

GRINDERS (Precision Thread)
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, Mich.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.

GRINDERS (Roll)
Mesta Machine Co., P. O. Box 1466 Pittsburgh, Pa.
Norton Co., Worcester, Mass.

GRINDERS (Rotary Surface)
Blanchard Machine Co., The, 64 State St., Cambridge, Mass.
Heald Machine Co., Worcester, Mass.
Lempco Products Inc., Dept. SS, Bedford, O.

GRINDERS (Sheet Steel & Internal Tube)
Mattison Machine Works, Rockford, Ill.

GRINDERS (Single Slide Internal)
Bryant Chucking Grinder Co., Springfield, Vt.

GRINDERS (Spline)
Fitchburg Grinding Machine Corp., Fitchburg, Mass.

GRINDERS (Surface)
Blanchard Machine Co., The, 64 State St., Cambridge, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Continental Machines, Inc., 1324 S. Washington Ave., Minneapolis, Minn.
Heald Machine Co., Worcester, Mass.
Lempco Products Inc., Dept. SS, Bedford, O.
Mattison Machine Works, Rockford, Ill.
Norton Company, Worcester, Mass.

GRINDERS (Tool and Cutter)
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Co., Inc., 11141 E. 8 Mile Rd., Detroit, Mich.
Cincinnati Milling Machine Co., Cincinnati, O.
Cleveland Tool Engineering Co., 9204 Detroit Ave., Cleveland, O.
Detroit Tap & Tool Co., 8432 Butler St., Detroit, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, Mich.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago, Ill.
Kearney & Trecker Corp., 5926 National Ave., Milwaukee, Wis.
LeBlond, R. K. Machine Tool Co., The, Dept. J-2, Cincinnati, O.
Norton Co., Worcester, Mass.
Oster Mfg. Co., The, 2037 E. 61st St., Cleveland, O.
Sellers, William, & Co., Inc., 16th & Callowhill Sts., Philadelphia, Pa.

GRINDING (Shear Knife)
American Shear Knife Co., P.O. Box 353, Homestead, Pa.

GRINDING AND LAPPING COMPOUNDS
Minnesota Mining & Mfg. Co., 900 Fauquier St., St. Paul, Minn.

GRINDING AND POLISHING COMPOUNDS
Carborundum Co., The, Niagara Falls, N. Y.
Minnesota Mining & Mfg. Co., 900 Fauquier St., St. Paul, Minn.
Stuart, D. A., Oil Co., Ltd., 2733 S. Troy St., Chicago, Ill.
Sun Oil Co., Dept. 1, 1603 Walnut St., Philadelphia, Pa.

GRINDING MACHINES (Gear)
Fitchburg Grinding Machine Corp., Fitchburg, Mass.

GRINDING MACHINES—See GRINDERS

GRINDING WHEELS
Abrasive Co., Tacony & Fraley Sts., Philadelphia, Pa.
Atkins, E. C., & Co., 427 S. Illinois St., Indianapolis, Ind.
Bay State Abrasive Products Co., Westboro, Mass.
Blanchard Machine, Co., The, 64 State St., Cambridge, Mass.
Carborundum Co., The, Niagara Falls, N. Y.
Chicago Wheel and Mfg. Co., Dept. ST, 1101 W. Monroe St., Chicago, Ill.
DeSanno, A. P., & Son Inc., 436 Wheatland St., Phoenixville, Pa.
Macklin Co., Jackson, Mich.
Norton Co., Worcester, Mass.
Sterling Grinding Wheel Div., Cleveland Quarries Co., Tiffin, O.

GRINDING WHEELS (Mounted)

Abrasive Co., Tacony & Fraley Sts., Philadelphia, Pa.
Bay State Abrasive Products Co., Westboro, Mass.
Carborundum Co., The, Niagara Falls, N. Y.
Chicago Wheel & Manufacturing Co., Dept. ST, 1101 W. Monroe St., Chicago, Ill.
DeSanno, A. P., & Son, Inc., Wheatland St., Phoenixville, Pa.
Macklin Co., Jackson, Mich.
Norton Co., Worcester, Mass.

GRINDING WHEELS (Segmental)

Abrasive Co., Tacony & Fraley Sts., Philadelphia, Pa.
Blanchard Machine Co., The, 64 State St., Cambridge, Mass.
Carborundum Co., The, Niagara Falls, N. Y.
Macklin Co., Jackson, Mich.
Norton Company, Worcester, Mass.
Sterling Grinding Wheel Div., Cleveland Quarries Co., Tiffin, O.

GUIDE SHOES

Youngstown Alloy Casting Corp., 103 E. Indianola Ave., Youngstown, O.

GUIDES (Mill)

Ampco Metal, Inc., Dept. S-1, 3830 W. Burnham St., Milwaukee, Wis.
National-Erie Corp., Erie, Pa.
Youngstown Alloy Casting Corp., 103 E. Indianola Ave., Youngstown, O.

GUNS (Blast Furnace Mud)

Bailey, Wm. M., Co., 702 Magee Bldg., Pittsburgh, Pa.
Brosius, Edgar E., Co., Sharpsburg Branch, Pittsburgh, Pa.

GUNS (Steam, Hydraulic, Electric)

Bailey, Wm. M., Co., 702 Magee Bldg., Pittsburgh, Pa.
Brosius, Edgar E., Co., Sharpsburg Branch, Pittsburgh, Pa.

HAMMER BOARDS

Irwin, H. G., Lumber Co., Garland, Pa.

HAMMERS (Drop)

Alliance Machine Co., The, Alliance, O.
Chambersburg Engineering Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Industrial Brownhoist Corp., Bay City, Mich.
Morgan Engineering Co., The, Alliance, O.
Standard Machinery Co., Providence, R. I.

HAMMERS (Power)

Yoder Co., The, W. 55th St. & Walworth Ave., Cleveland, O.

HAMMERS (Steam)

Alliance Machine Co., The, Alliance, O.
Chambersburg Engineering Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Industrial Brownhoist Corp., Bay City, Mich.
Morgan Engineering Co., The, Alliance, O.

HANGERS

Ahlberg Bearing Co., 3015 W. 47th St., Chicago, Ill.
Crane Co., 836 S. Michigan, Ave., Chicago, Ill.
Grinnell Co., Inc., Providence, R. I.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.

HANGERS (Shaft)

Bantam Bearings Corp., South Bend, Ind.
Fafnir Bearing Co., New Britain, Conn.
Hyatt Bearings Division, General Motors Corp., Harrison, N. J.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis, Ind.
New Departure Div., General Motors Corp., Bristol, Conn.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.

HEADING MACHINERY

Hydraulic Press Mfg. Co., Mt. Gilead, O.
National Machinery Co., Tiffin, O.

HEAT EXCHANGERS

Ross Heater & Mfg. Co., 1407 West Ave., Buffalo, N. Y.
Struthers Wells Corp., Titusville, Pa.

HEAT TREATING

Agerstrand Corp., Muskegon, Mich.
Lakeside Steel Improvement Co., The, 5418 Lakeside Ave., Cleveland, O.
Oliver Iron & Steel Corp., S. 10th & Muriel Sts., Pittsburgh, Pa.
Woodworth, N. A., Co., 1241 Wanda Ave., Ferndale, Mich.

HEAT TREATING MATERIALS

Houghton, E. F., & Co., Third, American & Somerset Sts., Philadelphia, Pa.
Park Chemical Co., 8076 Military Ave., Detroit, Mich.

HEATERS (Air)

Salem Engineering Co., 714 S. Broadway, Salem, O.

HEATERS (Electric Roll)

Freyn Engineering Co., 310 S. Michigan Ave., Chicago, Ill.

HEATERS (Electric Space)

American Foundry Equipment Co., The, Mishawaka, Ind.
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.
Graybar Electric Co., 420 Lexington Ave., New York City
Westinghouse Electric & Mfg. Co., Mansfield, O.

HEATERS (Instantaneous)

Ross Heater & Mfg. Co., 1407 West Ave., Buffalo, N. Y.

HEATERS (Unit)—See UNIT HEATERS

HELMETS

Kimball Safety Products Co., 7314 Wade Park Ave., Cleveland, O.

HELMETS (Blast Cleaning)

American Foundry Equipment Co., The, Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.
Vapor Blast Mfg. Co., 333 S. 16th St., Milwaukee, Wis.

HITCHINGS (Mine Car)

American Chain & Cable Co., Inc., Bridgeport, Conn.

HOB CHECKING MACHINES

Detroit Tap & Tool Co., 8432 Butler St., Detroit, Mich.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.

HOBS

Brown & Sharpe Mfg. Co., Providence, R. I.
Genesee Tool Co., Fenton, Mich.
Illinois Tool Works, 2501 N. Keeler Ave., Chicago, Ill.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.

HOISTS (Chain)

American MonoRail Co., The 13102 Athens Ave., Cleveland, O.
Chicago Tramrail Co., 2910 W. Carroll Ave., Chicago, Ill.
Cleveland Tramrail Div., of The Cleveland Crane & Engineering Co., 1125 E. 283rd St., Wickliffe, O.
Ford Chain Block Div. of American Chain & Cable Co. Inc., 2nd & Diamond Sts., Philadelphia, Pa.
Reading Chain & Block Corp., Dept. D-13, Reading, Pa.
Wright Mfg. Div. of American Chain & Cable Co., Inc., York, Pa.

HOISTS (Electric)

American Engineering Co., 2484 Aramingo Ave., Philadelphia, Pa.
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Chicago Tramrail Co., 2910 W. Carroll Ave., Chicago, Ill.
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., 1125 E. 283rd St., Wickliffe, O.
Economy Engineering Co., 2657 W. Van Buren St., Chicago, Ill.
Euclid Crane & Hoist Co., The, Chardon Rd., Euclid, O.
Graybar Electric Co., 420 Lexington Ave., New York City
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Industrial Brownhoist Corp., Bay City, Mich.
Manning, Maxwell & Moore, Inc., Shaw-Box Crane & Hoist Div., 406 Broadway, Muskegon, Mich.
Reading Chain & Block Corp., Dept. D-13, Reading, Pa.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.
Silent Hoist Winch & Crane Co., 849 63rd St., Brooklyn, N. Y.
Wright Mfg. Div. of American Chain & Cable Co. Inc., York, Pa.

HOISTS (Hand)

Economy Engineering Co., 2657 W. Van Buren St., Chicago, Ill.

HOISTS (Monorail)

American Engineering Co., 2484 Aramingo Ave., Philadelphia, Pa.
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Chicago Tramrail Co., 2910 W. Carroll Ave., Chicago, Ill.
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., 1125 E. 283rd St., Wickliffe, O.
Euclid Crane & Hoist Co., The, Chardon Rd., Euclid, O.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Manning, Maxwell & Moore, Inc., Shaw-Box Crane & Hoist Div., 406 Broadway, Muskegon, Mich.
Reading Chain & Block Corp., Dept. D-13, Reading, Pa.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.

HOISTS (Pneumatic)

Curtis Pneumatic Machinery Div. of Curtis Mfg. Co., 1996 Kienlen Ave., St. Louis, Mo.
Galland-Henning Mfg. Co., 2753 South 31st St., Milwaukee, Wis.
Hanna Engineering Works, 1763 Elston Ave., Chicago, Ill.

HONING MACHINES

Barnes, W. F. and John, Co., Rockford, Ill.
Micromatic Hone Corp., 8100 Schoolcraft Ave., Detroit, Mich.

HOOKS (Chain)

American Chain Div. American Chain & Cable Co., Inc., York, Pa.
Phoenix Mfg. Co., Joliet, Ill.

HOOPS (Welded Wire)

Keystone Steel & Wire Co., Dept. AC, Peoria, Ill.

HOOPS—See BANDS AND HOOPS (Iron and Steel)

HOSE (Flexible Metal)

American Metal Hose Branch of The American Brass Co., Waterbury, Conn.
Chicago Metal Hose Corp., 1315 S. Third St., Maywood, Ill.
Pennsylvania Flexible Metallic Tubing Co., 7219 Powers Lane, Philadelphia, Pa.

HOSE (Flexible Nonmetallic)

Weatherhead Co., The, 300 E. 131st St., Cleveland, O.

HOSE (Rubber)

United States Rubber Co., 1230 Sixth Ave., New York City.

HOSE REINFORCEMENT MACHINES

Fidelity Machine Co., 3908-18 Frankford Ave., Philadelphia, Pa.

HUMIDIFIERS (Industrial)

Grinnell Co., Inc., Providence, R. I.

HYDRAULIC MACHINERY

Alliance Machine Co., The, Alliance, O.
Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia, Pa.
Beatty Machine & Mfg. Co., Hammond, Ind.
Bethlehem Steel Co., Bethlehem, Pa.
Chambersburg Engineering Co., Chambersburg, Pa.
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.
Farquhar, A. B., Co., Ltd., 195 Duke St., York, Pa.
Hannifin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.
Hydraulic Machinery Inc., The, 10421 Grand River Ave., Detroit, Mich.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Hydropress, Inc., 570 Lexington Ave., New York City.
Morgan Engineering Co., The, Alliance, O.
National-Erie Corp., Erie, Pa.
Schloemann Engineering Corp., Empire Bldg., Pittsburgh, Pa.
Watson-Stillman Co., Roselle, N. J.
Weinman Pump & Supply Co., The, 210 Boulevard of the Allies, Pittsburgh, Pa.
Wood, R. D., Co., 400 Chestnut St., Philadelphia, Pa.

HYDRAULIC PRESSES—See PRESSES (Hydraulic)

HYDRAULIC UNITS

Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.
Hydraulic Machine Co., The, 10421 Grand River Ave., Detroit, Mich.
Racine Tool & Machine Co., Racine, Wis.
Weinman Pump & Supply Co., The, 210 Boulevard of the Allies, Pittsburgh, Pa.

INDICATORS (Blast Furnace Stock Line)

Foxboro Co., The, Foxboro, Mass.
Brosius, Edgar E., Co., Sharpsburg Branch, Pittsburgh, Pa.

INDICATORS (Temperature)

Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Brown Instrument Div. of Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia, Pa.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Hays Corp., The, Michigan City, Ind.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia, Pa.
Westinghouse Electric & Mfg. Co., Orange Ave., Newark, N. J.

INDUCTION BRAZING and SOLDERING EQUIPMENT

Johnson Gas Appliance Co., 591 "E" Ave., N.W., Cedar Rapids, Iowa
Lepel High Frequency Laboratories, Inc., 39 W. 60 St., New York City.
Ohio Crankshaft Co., The, 6600 Clement Ave., Cleveland, O.

INDUCTION HEATING and HARDENING EQUIPMENT

Lepel High Frequency Laboratories, Inc., 39 W. 60 St., New York City.
Ohio Crankshaft Co., The, 6600 Clement Ave., Cleveland, O.
Westinghouse Electric & Mfg. Co., Baltimore, Md.

INGOT MOLD WASH (Graphite)

National Carbon Co., W. 117th St. & Madison Ave., Cleveland, O.
United States Graphite Co., The, Saginaw, Mich.

INGOT MOLDS

Bethlehem Steel Co., Bethlehem, Pa.
National Carbon Co., W. 117th St. & Madison Ave., Cleveland, O.
Shenango-Penn Mold Co., Oliver Bldg., Pittsburgh, Pa.
Valley Mould & Iron Corp., Hubbard, O.

INHIBITORS

American Chemical Paint Co., Dept. 310 Ambler, Pa.
Parkin, Wm. M., Co., The, 1005 Highland Bldg., Pittsburgh, Pa.

INSPECTION EQUIPMENT

Sheffield Corp., The, 721 Springfield St., Dayton, O.
Trico Products Corp., 97 Burton St., Buffalo, N. Y.

INSPECTING TOOLS

Matthews, Jas. H., & Co., 3942 Forbes St., Pittsburgh, Pa.
Scherr, George, Co., 126 Lafayette St., New York City.
Sheffield Corp., The, 721 Springfield St., Dayton, O.
Trico Products Corp., 97 Burton St., Buffalo, N. Y.

INSTRUMENTS (Electric-Indicating and Recording)

Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Brown Instrument Div. of Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia, Pa.
Brush Development Co., 3311 Perkins Ave., Cleveland, O.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
General Electric Co., Sec. H, 750-159, Schenectady, N. Y. Schenectady, N. Y.
Graybar Electric Co., 420 Lexington Ave., New York City.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia, Pa.
Westinghouse Electric & Mfg. Co., Dept. 7N, East Pittsburgh, Pa.

INSULATING BLOCK

Harbison-Walker Refractories Co., Farmers Bank Bldg., Pittsburgh, Pa.
Illinois Clay Products Co., 214 Barber Bldg., Joliet, Ill.
Johns-Manville Corp., 22 E. 40th St., New York City.

INSULATING BRICK

Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.
Carborundum Co., The, Niagara Falls, N. Y.
Illinois Clay Products Co., 214 Barber Bldg., Joliet, Ill.
Johns-Manville Corp., 22 E. 40th St., New York City.
National Fireproofing Corp., 202 E. Ohio St., Pittsburgh, Pa.

INSULATING CONCRETE

Atlas Lumnite Cement Co., Dept. S, Chrysler Bldg., New York City.
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.
Harbison-Walker Refractories Co., Farmers Bank Bldg, Pittsburgh, Pa.
Illinois Clay Products Co., 214 Barber Bldg., Joliet, Ill.
Johns-Manville Corp., 22 E. 40th St., New York City.
Quigley Co., Inc. 56 W. 45th St., New York, N. Y.

INSULATING POWDER AND CEMENT

Ajax Electrothermic Corp., Ajax Park, Trenton, N. J.
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.
Harbison-Walker Refractories Co., Farmers Bank Bldg, Pittsburgh, Pa.
Illinois Clay Products Co., 214 Barber Bldg., Joliet, Ill.
Johns-Manville Corp., 22 E. 40th St., New York City.
Ramtite Co., The, Div. of the S. Obermayer Co., 2557 W. 18th St., Chicago, Ill.

INSULATION (Building)

Carey, Philip, Mfg. Co., The, Lockland, Cincinnati, O.
Johns-Manville Corp., 22 E. 40th St., New York City.

INSULATION (Furnace, Boiler Settings, Ovens, Steam Pipe, Etc.)

Harbison-Walker Refractories Co., Farmers Bank Bldg., Pittsburgh, Pa.
Illinois Clay Products Co., 214 Barber Bldg., Joliet, Ill.
Johns-Manville Corp., 22 E. 40th St., New York City.

IRON (Bar)

Ryerson, Jos. T., & Sons, Inc., 16th & Rockwell Sts., Chicago, Ill.

IRON ORE

Alan Wood Steel Co., Conshohocken, Pa.
Cleveland-Cliffs Iron Co., The, Union Commerce Bldg., Cleveland, O.
Hanna Furnace Corp., The, Ecorse, Detroit, Mich.
Shenango Furnace Co., Oliver Bldg., Pittsburgh, Pa.
Snyder, W. P., & Co., Oliver Bldg., Pittsburgh, Pa.
Youngstown Sheet & Tube Co., The Youngstown, O.

JACKS (Mechanical, Hydraulic, Screw)

Buda Co., The, Harvey, Ill.

JETS (Steam)

Parkin, Wm. M., Co., The 1005 Highland Bldg., Pittsburgh, Pa.

JIG BORERS

Bryant Machinery & Engineering Co., 400 W. Madison St., Chicago, Ill.
Cleereman Machine Tool Co., Green Bay, Wis.

JIGS AND FIXTURES

Agerstrand Corp., Muskegon, Mich.
Columbus Die, Tool & Mach. Co., 955 Cleveland Ave., Columbus, O.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Matthews, Jas. H., & Co., 3942 Forbes St., Pittsburgh, Pa.
Schnorr, C. H., & Co., 643 Railroad St., Springdale, Pa.
Sheffield Corp., The, 721 Springfield St., Dayton, O.
Zagar Tool, Inc., 23880 Lakeland Blvd., Euclid, O.

KETTLES (Galvanizing)

Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.

KEYS (Machine or Woodruff)

Moltrup Steel Products Co., Beaver Falls, Pa.

KEYSEATERS

Davis Keyseater Co., 399 Exchange St., Rochester, N. Y.

KNIVES

American Shear Knife Co., P. O. Box 355, Homestead, Pa.
Atkins, E. C., & Co., 427 S. Illinois St., Indianapolis, Ind.
Cowles Tool Co., 2086 W. 110th St., Cleveland, O.
Disston, Henry, & Sons, Inc., 1226 Tacony, Philadelphia, Pa.
Ohio Knife Co., Dreman Ave. & B. & O. R.R., Cincinnati, O.
Wapakoneta Machine Co., The, Wapakoneta, Ohio

LABORATORY EQUIPMENT

Dietert, Harry W., Co., 9330J Roselawn Ave., Detroit, Mich.

LABORATORY WARE

Bay State Abrasive Products Co., Westboro, Mass.
Norton Company, Worcester, Mass.

LADLES

Bartlett-Hayward Div., Koppers Co., Baltimore, Md.
Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.

LANTERNS (Signal and Safety)

The Linfern Corp., Lincoln Ave., Berea, O.

LAPPING MACHINES

Cincinnati Grinders, Incorporated, Cincinnati, O.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, Mich.
National Broach & Machine Co., 5600 St. Jean, Detroit, Mich.
Norton Company, Worcester, Mass.

LARRIES (Coal)

Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.

LATHE CENTERS

Carboloy Co., Inc., 11141 E. 8 Mile Rd., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Genesee Tool Co., Fenton, Mich.
McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.
South Bend Lathe Works, South Bend, Ind.

LATHE DOGS (Drop Forged)

Williams, J. H., & Co., 400 Vulcan St., Buffalo, N. Y.
South Bend Lathe Works, South Bend, Ind.

LATHE TOOLS (Carbide Tipped)

McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.

LATHES

Consolidated Machine Tool Corp., Winton & Blossom Rds., Rochester, N. Y.
Hepburn American Co., Maher Bldg., Greenwich, Conn.
Jones & Lamson Machine Co., Springfield, Vt.
LeBlond, R. K., Machine Tool Co. The, Dept. J-2 Cincinnati, O.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Monarch Machine Tool Co., Sidney, O.
Sheffield Corp., The, 721 Springfield St., Dayton, O.
Simmons Machine Tool Corp., 1850 N. Broadway, Albany, N. Y.
South Bend Lathe Works, South Bend, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland, O.

LATHES (Automatic)

Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Co., The, Bridgeport, Conn.
Gisholt Machine Co., 1217 E. Washington Ave., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vt.
LeBlond, R. K. Machine Tool Co., The, Dept. J-2, Cincinnati, O.
Monarch Machine Tool Co., Sidney, O.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Wickes Brothers, Saginaw, Mich.

LATHES (Buffing & Polishing)

Chicago Wheel & Mfg. Co., Dept. ST, 1101 W. Monroe St., Chicago, Ill.
Walker-Turner Co., Inc., 5013 Berckman St., Plainfield, N. J.

LATHES (Chucking)

Bullard Co., The, Bridgeport, Conn.
Gisholt Machine Co., 1217 E. Washington Ave., Madison, Wis.
Hepburn American Co., Maher Bldg., Greenwich, Conn.
Oster Mfg. Co., The, 2037 E. 61st St., Cleveland, O.

LATHES (Crankshaft)

LeBlond, R. K. Machine Tool Co., The, Dept. J-2, Cincinnati, O.
Lempco Products Inc., Dept. SS, Bedford, O.
Wickes Brothers, Saginaw, Mich.

LATHES (Double End)

Consolidated Machine Tool Corp., Winton & Blossom Rds., Rochester, N. Y.
Wickes Brothers, Saginaw, Mich.

LATHES (Engine)

Consolidated Machine Tool Corp., Winton & Blossom Rds., Rochester, N. Y.
LeBlond, R. K. Machine Tool Co., The, Dept. J-2, Cincinnati, O.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Monarch Machine Tool Co., Sidney, O.
Simmons Machine Tool Corp., 1850 N. Broadway, Albany, N. Y.
South Bend Lathe Works, South Bend, Ind.
Wickes Brothers, Saginaw, Mich.

LATHES (Gun)

Consolidated Machine Tool Corp., Winton & Blossom Rds., Rochester, N. Y.
LeBlond, R. K. Machine Tool Co., The, Dept. J-2, Cincinnati, O.
Wickes Brothers, Saginaw, Mich.

LATHES (Railroad Car & Driving Wheel)

Consolidated Machine Tool Corp., Winton & Blossom Rds., Rochester, N. Y.
Sellers, William, & Co., Inc., 16th & Callowhill Sts., Philadelphia, Pa.

LATHES (Roll Turning)

Aetna-Standard Engineering Co., The Home Savings Bank Bldg., Youngstown, Ohio
Consolidated Machine Tool Corp., Winton & Blossom Rds., Rochester, N. Y.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Hyde Park Foundry & Machine Co., Hyde Park, Pa.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Mackintosh-Hemphill Co., 9th and Bingham Sts., Pittsburgh, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Simmons Machine Tool Corp., 1850 N. Broadway, Albany, N. Y.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland, O.

LATHES (Turret)

Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Company, The, Bridgeport, Conn.
Gisholt Machine Co., 1217 E. Washington Ave., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vt.
Oster Mfg. Co., The, 2037 E. 61st St., Cleveland, O.
Simmons Machine Tool Corp., 1850 N. Broadway, Albany, N. Y.
South Bend Lathe Works, South Bend, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland, O.

LATHES (Turret, Vertical)

Bullard Co., The, Bridgeport, Conn.

LEAD (Red or White)

National Lead Co., 111 Broadway, New York City

LEAD (Sheets, Pipe, etc.)

National Lead Co., 111 Broadway, New York City

LEAD (Tellurium)

National Lead Co., 111 Broadway, New York City.

LEVELING MACHINES

Aetna-Standard Engineering Co., The, Home Savings Bank Bldg., Youngstown, O.
Erie Foundry Co., Erie, Pa.
Hyde Park Foundry & Machine Co., Hyde Park, Pa.
Hydropress, Inc., 570 Lexington Ave., New York City.
McKay Machine Co., Youngstown, O.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Wean Engineering Co., Warren, O.

LIFTERS (Hand & Electric)

Economy Engineering Co., 2657 W. Van Buren St., Chicago, Ill.

LIFTERS (Machine Shop)
Economy Engineering Co., 2657 W. Van Buren St., Chicago, Ill.

LIFT TRUCKS—See TRUCKS (Lift)

LIFTING MAGNETS—See MAGNETS (Lifting)

LIFTS (Monorail)
American MonoRail Co., The 13102 Athens Ave., Cleveland, O.
Cleveland Crane & Engineering Co., The, 1125 E. 283rd St., Wickliffe, O.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.

LIGHTING (Fluorescent Equipment)
General Electric Co., Bridgeport, Conn.
Graybar Electric Co., 420 Lexington Ave., New York City
Guth, Edwin F., Co., The, 2615 Washington Ave., St. Louis, Mo.
Ward Leonard Electric Co., Mt. Vernon, N. Y.
Westinghouse Electric & Mfg. Co., 1216 W. 58th St., Cleveland, O.

LIGHTING (Industrial)
Graybar Electric Co., 420 Lexington Ave., New York City.
Guth, Edwin F., Co., The, 2615 Washington Ave., St. Louis, Mo.
Pittsburgh Reflector Co., Oliver Bldg., Pittsburgh, Pa.
Westinghouse Electric & Mfg. Co., 1216 W. 58th St., Cleveland, O.

LIME (Chemical and Fluxing)
Baker, The J. E. Co., 114 N. George St., York, Pa.

LIMESTONE (Open Hearth & Blast Furnace)
Baker, The J. E. Co., 114 N. George St., York, Pa.
Basic Refractories, Inc., Hanna Bldg., Cleveland, O.

LINERS (Pump and Cylinder)
Shenango-Penn Mold Co., 407 W. Third St., Dover, O.

LOCOMOTIVE CRANES—See CRANES (Locomotive)

LOCOMOTIVES (Diesel-Electric)
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
Cooper-Bessemer Corp., The, Mt. Vernon, O.
Davenport-Besler Corp., Davenport, Iowa.
Plymouth Locomotive Works, Div., Fate-Root-Heath Co., Plymouth, O.
Porter, H. K., Co., Inc., 49th & Harrison Sts., Pittsburgh, Pa.
Whitcomb Locomotive Co., Rochelle, Ill.

LOCOMOTIVES (Diesel-Mechanical)
Davenport-Besler Corp., Davenport, Iowa.
Plymouth Locomotive Works, Div., Fate-Root-Heath Co., Plymouth, O.
Porter, H. K., Co., Inc., 49th & Harrison Sts., Pittsburgh, Pa.
Whitcomb Locomotive Co., Rochelle, Ill.

LOCOMOTIVES (Electric)
Davenport-Besler Corp., Davenport, Iowa.
Porter, H. K., Co., Inc., 49th & Harrison Sts., Pittsburgh, Pa.

LOCOMOTIVES (Electric Trolley)
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
General Electric Co., Sec. H, 750-159, Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.
Whitcomb Locomotive Co., Rochelle, Ill.

LOCOMOTIVES (Fireless)
Porter, H. K., Co. Inc., 49th & Harrison Sts., Pittsburgh, Pa.

LOCOMOTIVES (Gasoline-Electric)
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
Davenport-Besler Corp., Davenport, Iowa.
General Electric Co., Sec. H, 750-159, Schenectady, N. Y.
Plymouth Locomotive Works, Div., Fate-Root-Heath Co., Plymouth, O.
Whitcomb Locomotive Co., Rochelle, Ill.

LOCOMOTIVES (Gasoline Mechanical)
Davenport-Besler Corp., Davenport, Iowa.
Plymouth Locomotive Works, Div., Fate-Root-Heath Co., Plymouth, O.
Whitcomb Locomotive Co., Rochelle, Ill.

LOCOMOTIVES (Oil-Electric)
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.

LOCOMOTIVES (Steam)
Davenport-Besler Corp., Davenport, Iowa.
Porter, H. K., Co. Inc., 49th & Harrison Sts., Pittsburgh, Pa.

LOCOMOTIVES (Storage Battery)
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
General Electric Co., Sec. H, 750-159, Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.
Whitcomb Locomotive Co., Rochelle, Ill.

LUBRICANTS (Graphite)
Acheson Colloids Corp., Port Huron, Mich.
United States Graphite Co., The, Saginaw, Mich.

LUBRICANTS (Industrial)
Acheson Colloids Corp., Port Huron, Mich.
Cities Service Companies, 70 Pine St., New York City.
Houghton, E. F., & Co., Third, American & Somerset Sts., Philadelphia, Pa.
New York & New Jersey Lubricant Co., 292 Madison Ave., New York City.
Shell Oil Co., Inc., 50 W. 50th St., New York City.
Sinclair Refining Co., 630 Fifth Ave., New York City.
Socony-Vacuum Oil Co., Inc., 26 Broadway, New York City.
Stuart, D. A., Oil Co., Ltd., 2733 S. Troy St., Chicago, Ill.
Sun Oil Co., Dept. 1, 1608 Walnut St., Philadelphia, Pa.
Texas Co., The, 135 East 42nd St., New York, N. Y.
Tide Water Associated Oil Co., 17 Battery Place, New York City.

LUBRICATING SYSTEMS
Farval Corp., The, 3270 E. 80th St., Cleveland, O.

LUGS (Terminal)
Calumet and Hecla Consolidated Copper Co., Wolverine Tube Div., 1435 Central Ave., Detroit, Mich.

MACHINE WORK
Agerstrand Corp., Muskegon, Mich.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Metal Products Co., 5959 Lindale Ave., Detroit, Mich.
Bartlett-Hayward Div., Koppers Co., Baltimore, Md.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Doyle, The, J. E., Co., 1220 West 6th St., Cleveland, O
Federal Shipbuilding & Dry Dock Co., Kearny, N. J.
Fidelity Machine Co., 3908-18 Frankford Ave., Philadelphia, Pa.
Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill.
Hyde Park Foundry & Machine Co., Hyde Park, Pa.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Morgan Engineering Co., The, Alliance, O.
Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.
Scaife Co., Ann St., Oakmont, Pa.

MACHINERY (Bag Closing)
Fidelity Machine Co., 3908 Frankford Ave., Philadelphia, Pa.

MACHINERY (Drilling, Reaming, Countersinking, Portable)
Guibert Steel Co., 1716 Youghiogheny Ave., McKees Rocks, Pa.

MACHINERY (Flexible Shaft)
Walker-Turner Co., Inc., 5013 Berckman St., Plainfield, N. J.

MACHINERY (Special)
Aetna-Standard Engineering Co., The Home Savings Bank Bldg., Youngstown, O.
American Foundry Equipment Co., The, Mishawaka, Ind.
Alliance Machine Co., The, Alliance, O.
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia, Pa.
Barnes, W. F. and John, Co., Rockford, Ill.
Bartlett-Hayward Div., Koppers Co., Baltimore, Md.
Bayard, M. L., & Co., 20th & Indiana Ave., Philadelphia, Pa.
Beatty Machine & Mfg. Co., Hammond, Ind.
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Bliss, E. W., Co., 53rd St. & 2nd Ave., Brooklyn, N. Y.
Brosius, Edgar E., Co., Sharpsburg Branch, Pittsburgh, Pa.
Cleveland Automatic Machine Co., 2269 Ashland Ave., Cleveland, O.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.
Columbus Die, Tool & Mach. Co., 955 Cleveland Ave., Columbus, O.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.
Etna Machine Co., The, 3400 Maplewood Ave., Toledo, O.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, Mich.
Farquhar, A. B., Co., Ltd., 195 Duke St., York, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Fidelity Machine Co., 3908-18 Frankford Ave., Philadelphia, Pa.
Foote Bros. Gear & Machine Co., 5301 S. Western Blvd., Chicago, Ill.
Greenlee Bros. & Co., Rockford, Ill.
Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago, Ill.
Hepburn American Co., Maher Bldg., Greenwich, Conn.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Kane & Roach, Inc., Niagara & Shonnard Sts., Syracuse, N. Y.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Morgan Engineering Co., The, Alliance, O.
National Broach & Machine Co., 5600 St., Jean, Detroit, Mich.
National-Erie Corp., Erie, Pa.
National Roll & Fdry. Co., The, Avonmore, Pa.
Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y.
Oil Well Supply Co., Dallas, Texas.
Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.
Sellers, William, & Co., Inc., 16th & Callohill Sts., Philadelphia, Pa.
Sheffield Corp., The, 721 Springfield St., Dayton, O.
Shuster, F. B., Co., The, New Haven, Conn.
Simmons Machine Tool Corp., 1850 N. Broadway, Albany, N. Y.
Standard Machinery Co., Providence, R. I.
Struthers Wells Corp., Titusville, Pa.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Thomas Machine Mfg. Co., Etna Branch P. O., Pittsburgh, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.
Wood, R. D., Co., 400 Chestnut St., Philadelphia, Pa.
Yoder Co., The, W. 55th St. & Walworth Ave., Cleveland, O.

MACHINERY (Used & Rebuilt)
Albert, L., & Son, Whitehead Rd., Trenton, N. J.
Emerman, Louis E., & Co., 1761 Elston Ave., Chicago, Ill.
Galbreath Machinery Co., Empire Bldg., Pittsburgh, Pa.
General Blower Co., 404 N. Peoria St., Chicago, Ill.
Iron & Steel Products, Inc., Hegewisch Sta., Chicago, Ill.
Lang Machinery Co., 28th & A.V.R.R., Pittsburgh, Pa.
Motor Repair & Mfg. Co., 1558 Hamilton Ave., Cleveland, O.
Simmons Machine Tool Corp., 1850 N. Broadway, Albany, N. Y.
West Penn Machinery Co., 1208 House Bldg., Pittsburgh, Pa.

MACHINES (Marking)
Matthews, Jas. H., & Co., 3942 Forbes St., Pittsburgh, Pa.

MAGNESIA (Electrically Fused)
Norton Co., Worcester, Mass.

MAGNESIA-REFRACTORIES—See REFRACTORIES (Magnesia)

MAGNESIUM
Dow Chemical Co., The, Midland, Mich.

MAGNETIC SEPARATORS—See SEPARATORS (Magnetic)

MAGNETS (Lifting)
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.
Electric Controller & Mfg. Co., 2700 E. 79th St., Cleveland, O.
Ohio Electric Mfg. Co., The, 5906 Maurice Ave., Cleveland, O.

MAGNETS (Separating)
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.
Electric Controller & Mfg. Co., The 2698 E. 79th St., Cleveland, O.
Ohio Electric Mfg. Co., The, 5906 Maurice Ave., Cleveland, O.

MANGANESE METAL AND ALLOYS
Electro Metallurgical Co., 30 E. 42nd St., New York City.

MANGANESE ORE
Cuban-American Manganese Corp., 122 E. 42nd St., New York City.
Samuel, Frank, & Co., Inc., Harrison Bldg., Philadelphia, Pa.

MANIPULATORS
Alliance Machine Co., The, Alliance, O.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Morgan Engineering Co., The, Alliance, O.
Wellman Engineering Co., The, 7000 Central Ave., Cleveland, O.

MARKING DEVICES
Cunningham, M. E., Co., 172 E. Carson St., Pittsburgh, Pa.
Helmer-Staley, Inc., 327 W. Huron St., Chicago, Ill.
Matthews, Jas. H., & Co., 3978 Forbes St., Pittsburgh, Pa.

METAL (Perforated)—See PERFORATED METAL

METAL BLAST ABRASIVES (Shot and Grit)
American Foundry Equipment Co., The 509 S. Byrkit St., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.
Pittsburgh Crushed Steel Co., 4839 Harrison St., Pittsburgh, Pa.
Vapor Blast Mfg. Co., 333 S. 10th St., Milwaukee, Wis.

METAL CLEANERS

American Chemical Paint Co., Dept. 310, Ambler, Pa.
Detroit Rex Products Co., 13005 Hillview Ave., Detroit, Mich.
Houghton, E. F., & Co., Third, American & Somerset Sts., Philadelphia, Pa.
MacDermid, Inc., Waterbury, Conn.
Pennsylvania Salt Mfg. Co., Dept. S. Pennsalt Cleaner Div., Philadelphia, Pa.
Turco Products, Inc., 6135 S. Central Ave., Los Angeles, Calif.
Udylite Corp., The, 1651 E. Grand Blvd., Detroit, Mich.

METAL CLEANING MACHINES

American Foundry Equipment Co., The, Mishawaka, Ind.
Bullard Co., The, Bridgeport, Conn.
Detroit Rex Products Co., 13005 Hillview Ave., Detroit, Mich.
Pangborn Corporation, Hagerstown, Md.
Ransohoff, N., Inc., 1317 Township Ave., Cincinnati, O.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Vapor Blast Mfg. Co., 333 S. 16th St., Milwaukee, Wis.

METAL DUPLICATION (Without Dies)

O'Neil-Irwin Mfg. Co., 304 8th Ave., So., Minneapolis, Minn.

METAL FINISHES

Alrose Chemical Co., 180 Mill St., Providence, R. I.
American Nickeloid Co., 1310 N. Second St., Peru, Ill.

METAL FORMING MACHINERY

Beatty Machine & Mfg. Co., Hammond, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y.
O'Neil-Irwin Mfg. Co., 304 8th Ave., So., Minneapolis, Minn.
Watson-Stillman Co., Roselle, N. J.

METALS (Nonferrous)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh, Pa.
American Brass Co., The, Waterbury, Conn.
Dow Chemical Co., The, Midland, Mich.
International Nickel Co., Inc., The, 67 Wall St., New York City.
Revere Copper & Brass Co., Inc., 230 Park Ave., New York City

METERS (Air & Hydraulic)

Foxboro Co., The, Foxboro, Mass.

MICROMETERS

Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., 126 Lafayette St., New York City

MILLING CUTTERS

Atkins, E. C., & Co., 427 S. Illinois St., Indianapolis, Ind.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Co., Inc., 11141 E. 8 Mile Rd., Detroit, Mich.
Detroit Tap & Tool Co., 8432 Butler St., Detroit, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Genesee Tool Co., Fenton, Mich.
Illinois Tool Works, 2501 N. Keeler Ave., Chicago, Ill.
McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.

MILLING MACHINE ATTACHMENTS

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee, Wis.

MILLING MACHINES

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, O.
Consolidated Machine Tool Corp., Winton & Blossom Rds., Rochester, N. Y.
Davis & Thompson Co., 6619 W. Mitchell St., Milwaukee, Wis.
Kearney & Trecker Corp., 5926 National Ave., Milwaukee, Wis.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee, Wis.
National Broach & Machine Co., 5600 St. Jean, Detroit, Mich.
Ohio Machine Tool Co., The, Kenton, O.
Sellers, William, & Co., Inc., 16th & Callowhill Sts., Philadelphia, Pa.
Simmons Machine Tool Corp., 1850 N. Broadway, Albany, N. Y.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Van Norman Machine Tool Co., Springfield, Mass.

MILLING MACHINES (Milling and Centering Combined)

Jones & Lamson Machine Co., Springfield, Vt.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

MILLS (Blooming, Universal, Plate, Sheet, Tin, Bar, Strip, Etc.)—See ROLLING MILL EQUIPMENT

MIXERS (Hot Metal)

Bartlett-Hayward Div., Koppers Co., Baltimore, Md.

MOLD PLUGS

McLain Fire Brick Co., 1239 Gulf Bldg., Pittsburgh, Pa.
National Carbon Co., W. 117th St. & Madison Ave., Cleveland, O.

MOLDING MACHINERY (Foundry)

Milwaukee Foundry Equipment Co., 3238 W. Pierce St., Milwaukee, Wis.

MOLDS (Ingot)—See INGOT MOLDS

MOLYBDENUM

Climax Molybdenum Co., 500 Fifth Ave., New York City.
Molybdenum Corp. of America, Grant Bldg., Pittsburgh, Pa.

MONEL METAL (All Commercial Forms)

International Nickel Co., Inc., The, 67 Wall St., New York City.

MONORAIL SYSTEMS

American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., 1125 E. 283rd St., Wickliffe, O.
Reading Chain & Block Corp., Dept. D-13, Reading, Pa.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.

MOTOR-ROLLERS

Schloemann Engineering Corp., Empire Bldg., Pittsburgh, Pa.

MOTOR CONTROL (Electric)

Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.

MOTOR CONTROLS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Electric Controller & Mfg. Co., The, 2698 E. 79th St., Cleveland, O.
Graybar Electric Co., 420 Lexington Ave., New York City
Ward Leonard Electric Co., Mt. Vernon, N. Y.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

MOTORS (Electric)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Century Electric Co., 1806 Pine St., St. Louis, Mo.
Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.
General Electric Co., Sec. H, 750-159, Schenectady, N. Y.
Graybar Electric Co., 420 Lexington Ave., New York City
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Lincoln Electric Co., The, Cleveland, O.
Reliance Electric & Eng. Co., 1088 Ivanhoe Rd., Cleveland, O.
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.
Walker-Turner Co., Inc., 5013 Berckman St., Plainfield, N. J.
Ward Leonard Electric Co., Mt. Vernon, N. Y.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

MUCK BAR

Samuel, Frank, & Co., Inc., Harrison Bldg., Philadelphia, Pa.
Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh, Pa.

NAILS (*Also Stainless)

Alan Wood Steel Co., Conshohocken, Pa.
Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh, Pa.
American Steel and Wire Co., Rockefeller Bldg., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
*Hassall, John, Inc., 402 Oakland St., Brooklyn, N. Y.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Keystone Steel & Wire Co., Dept. AC, Peoria, Ill.
*Republic Steel Corp., Dept. ST, Cleveland, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Wickwire Brothers, 189 Main St., Cortland, N. Y.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.
Youngstown Sheet & Tube Co., The, Youngstown, O.

NAILS (Coated & Galvanized)

Alan Wood Steel Co., Conshohocken, Pa.
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Keystone Steel & Wire Co., Peoria, Ill.
Wickwire Brothers, 189 Main St., Cortland, N. Y.
Youngstown Sheet & Tube Co., The, Youngstown, O.

NAME PLATES

Avery Adhesives, 451 E. 3rd St., Los Angeles, Cal.
Matthews, Jas. H., & Co., 3942 Forbes St., Fittsburgh, Pa.

NIBBLING MACHINES

Andrew C. Campbell Div., American Chain & Cable Co., Inc., Bridgeport, Conn.

NICKEL (All Commercial Forms)

International Nickel Co., Inc., The, 67 Wall St., New York City.

NICKEL (Shot)

International Nickel Co., Inc., The, 67 Wall St., New York City.

NOZZLES (Blast)

American Foundry Equipment Co., The, 509 S. Byrkit St., Mishawaka, Ind.
Pangborn Corporation, Hagerstown, Md.
Vapor Blast Mfg. Co., 333 S. 16th St., Milwaukee, Wis.

NOZZLES (Descaling)

Aldrich Pump Co., 2 Gordon St., Allentown, Pa.
American Foundry Equipment Co., The, Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.

NUTS (*Also Stainless)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Cap Screw Co., 2917 E. 79th St., Cleveland, O.
*Elastic Stop Nut Corp., 2340A Vauxhall Rd., Union, N. J.
*Harper, H. M. Co., The, 2646 Fletcher St., Chicago, Ill.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
*Oliver Iron & Steel Corp., So. 10th & Muriel Sts., Pittsburgh, Pa.
*Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Tinnerman Products, Inc., 2039 Fulton Rd., Cleveland, O.
Triplex Screw Co., 5341 Grant Ave. Cleveland, O.

NUTS (Castellated)

Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Cap Screw Co., 2917 E. 79th St., Cleveland, O.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
National Acme Co., The, 170 E. 131 St., Cleveland, O.
Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

NUTS (Machine Screw)

Elastic Stop Nut Corp., 2340A Vauxhall Rd., Union, N. J.
Central Screw Company, 3517 Shields Ave., Chicago, Ill.

NUTS (Nonferrous)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh, Pa.
Elastic Stop Nut Corp., 2340A Vauxhall Rd., Union, N. J.
Harper, H. M., Co., The, 2646 Fletcher St., Chicago, Ill.

NUTS (Self Locking)

Elastic Stop Nut Corp., 2367 Vauxhall Rd., Union, N. J.
Prestole Div. Detroit Harvester Co., 4500 Detroit Ave., Toledo, O.
Tinnerman Products, Inc., 2039 Fulton Rd., Cleveland, O.

NUTS (Semi-finished)

Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Cap Screw Co., 2917 E. 79th St., Cleveland, O.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
Oliver Iron & Steel Corp., S. 10th & Muriel Sts., Pittsburgh, Pa.
Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Tinnerman Products, Inc., 2039 Fulton Rd., Cleveland, O.

NUTS (Spring—Tension)

Prestole Div. Detroit Harvester Co., 4500 Detroit Ave., Toledo, O.

NUTS (Wing)

Central Screw Company, 3517 Shields Ave., Chicago, Ill.
Parker-Kalon Corp., 194-200 Varick St., New York City.

OIL SEALS

Chicago Rawhide Mfg. Co., 1308 Elston Ave., Chicago, Ill.

OILS (Cutting)

Cities Service Companies, 70 Pine St., New York City.
Oster Mfg. Co., The, 2037 E. 61st St., Cleveland, O.
Shell Oil Co., Inc., 50 W. 50th St., New York City.
Sinclair Refining Co., 630 Fifth Ave., New York City.
Socony-Vacuum Oil Co., Inc., 26 Broadway, New York City.
Stuart, D. A., Oil Co. Ltd., 2733 S. Troy St., Chicago, Ill.
Sun Oil Co., Dept. 1, 1608 Walnut St., Philadelphia, Pa.
Texas Co., The, 135 East 42nd St., New York, N. Y.
Tide Water Associated Oil Co., 17 Battery Place, New York City.

OILS (Lubricating)—See LUBRICANTS (Industrial)

OILS (Quenching)

Park Chemical Co., 8076 Military Ave., Detroit, Mich.

OPEN-HEARTH FURNACES—See FURNACES (Open-Hearth)

OVENS (Annealing, Japanning, Tempering)

Electric Furnace Co., The, Salem, O.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Maehler, Paul, Co., The, 2208 W. Lake St., Chicago, Ill.
Mahr Mfg. Co., 1702 N. Second St., Minneapolis, Minn.
Salem Engineering Co., 714 S. Broadway, Salem, O.

OVENS (Coke, By-Product Recovery)

Koppers Co., Engineering and Construction Div., 901 Koppers Bldg., Pittsburgh, Pa.

OVENS (Core and Mold)

Bartlett, C. O., & Snow Co., 6200 Harvard Ave., Cleveland, O.
Maehler, Paul, Co., The, 2208 W. Lake St., Chicago, Ill.
Mahr Mfg. Co., 1702 N. Second St., Minneapolis, Minn.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh, Pa.

OVENS (Gas or Oil Heat)

Maehler, Paul, Co., The, 2208 W. Lake St., Chicago, Ill.
Mahr Mfg. Co., 1702 N. Second St., Minneapolis, Minn.
Salem Engineering Co., 714 S. Broadway, Salem, O.

OXY-ACETYLENE WELDING AND CUTTING—See WELDING

OXYGEN GENERATORS

Independent Engineering Co., O'Fallon, Ill.

OXYGEN IN CYLINDERS

Air Reduction, 60 E. 42nd St., New York City.
Linde Air Products Co., The, 30 E. 42nd St., New York City.
National Cylinder Gas Co., 205 W. Wacker Drive, Chicago, Ill.

PACKING (Asbestos or Rubber)

Carey, Philip, Mfg. Co., The, Lockland, Cincinnati, O.
Johns-Manville Corp., 22 E. 40th St., New York City.

PACKING (Carbon or Graphite)

National Carbon Co., W. 117th St. & Madison Ave., Cleveland, O.

PACKINGS—MECHANICAL LEATHER (Cup, U-Cup, Flange and Vees)

Chicago Rawhide Mfg. Co., 1308 Elston Ave., Chicago, Ill.
Excelsior Leather Washer Mfg. Co., Inc., Rockford, Ill.

PAINT (Alkali Resisting)

Pennsylvania Salt Mfg. Co., Widener Bldg., Philadelphia, Pa.

PAINT (Aluminum)

Koppers Co., Tar & Chemical Div., 300 Koppers Bldg., Pittsburgh, Pa.

PAINT (Heat Resisting, Rust Preventing, Priming)

American Chemical Paint Co., Dept. 310, Ambler, Pa.
Koppers Co., Tar & Chemical Div., 300 Koppers Bldg., Pittsburgh, Pa.
Pennsylvania Salt Mfg. Co., Widener Bldg., Philadelphia, Pa.
Quigley Co., Inc., 56 W. 45th St., New York City

PAINT (Industrial)

Carey, Philip, Mfg. Co., Inc., Lockland, Cincinnati, O.
National Lead Co., 111 Broadway, New York City

PAINT (Marking)

Helmer-Staley, Inc., 327 W. Huron St., Chicago, Ill.
Koppers Co., Tar & Chemical Div., 300 Koppers Bldg., Pittsburgh, Pa.

PAINT (Stick Form)

Helmer-Staley, Inc., 327 W. Huron St., Chicago, Ill.

PAINTING

Hanlon-Gregory Galvanizing Co., 5515 Butler St., Pittsburgh, Pa.

PAPER PRODUCTS

Dennison, Dept. 78, War Production Div., Framingham, Mass.

PARTS (Precision)

Doyle, The, J. E., Co., 1220 West 6th St., Cleveland, O.
Elastic Stop Nut Corp., 2340A Vauxhall Rd., Union, N. J.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, Mich.
Fidelity Machine Company, 3908 Frankford Ave., Philadelphia, Pa.
Woodworth, N. A., Co., 1241 Wanda Ave., Ferndale, Mich.

PATTERNS (Wood or Metal)

Wellman Bronze & Aluminum Co., The, 2539 E. 93 St., Cleveland, O.

PERFORATED METAL

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Chicago Perforating Co., 2443 W. 24th Pl., Chicago, Ill.
Erdle Perforating Co., 171 York St., Rochester, N. Y.
Harrington & King Perforating Co., 5634 Fillmore St., Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.

PHENOL RECOVERY PLANTS

Koppers Co., Engineering and Construction Div., 901 Koppers Bldg., Pittsburgh, Pa.

PHOSPHOR BRONZE—See BRASS, BRONZE, COPPER, PHOSPHOR BRONZE

PICKLING

Hanlon-Gregory Galvanizing Co., 5515 Butler St., Pittsburgh, Pa.

PICKLING COMPOUNDS

American Chemical Paint Co., Dept. 310, Ambler, Pa.
Houghton, E. F., & Co., Third, American & Somerset Sts., Philadelphia, Pa.
Parkin, Wm. M., Co., The, 1005 Highland Bldg., Pittsburgh, Pa.
Pennsylvania Salt Mfg. Co., Widener Bldg., Philadelphia, Pa.

PICKLING EQUIPMENT

International Nickel Co., Inc., The, 67 Wall St., New York City.
National Carbon Co., W. 117th St. & Madison Ave., Cleveland, O.
Ransohoff, N., Inc., 1317 Township Ave., Cincinnati, O.
Salem Engineering Co., 714 S. Broadway, Salem, O.

PICKLING MACHINERY

Aetna-Standard Engineering Co., The, Home Savings Bank Bldg., Youngstown, O.
Erie Foundry Co., Erie, Pa.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Wean Engineering Co., Warren, O.

PICKLING TANK LININGS

Cellcote Co., 750 Rockefeller Bldg., Cleveland, O.
Harbison-Walker Refractories Co., Farmers Bank Bldg., Pittsburgh, Pa.
National Carbon Co., W. 117th St. & Madison Ave., Cleveland, O.
Pennsylvania Salt Mfg. Co., Widener Bldg., Philadelphia, Pa.

PICKLING TANKS —See TANKS (Pickling)

PIERCER POINTS

Youngstown Alloy Casting Corp., 103 E. Indianola Ave., Youngstown, O.

PIG IRON

Alan Wood Steel Co., Conshohocken, Pa.
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Brooke, E. & G., Iron Co., Birdsboro, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Cleveland-Cliffs Iron Co., The, Union Commerce Bldg., Cleveland, O.
Columbia Steel Co., Russ Bldg., San Francisco, Calif.
Hanna Furnace Corp., The, Ecorse, Detroit, Mich.
Jackson Iron & Steel Co., Jackson, O.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Samuel, Frank & Co., Inc., Harrison Bldg., Philadelphia, Pa.
Shenango Furnace Co., Oliver Bldg., Pittsburgh, Pa.
Snyder, W. P., & Co., Oliver Bldg., Pittsburgh, Pa.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.

PILING (Iron and Steel)

Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
National Tube Co., Frick Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.

PILING (Pipe)

American Rolling Mill Co., The, 3271 Curtis St., Middletown, O.
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
National Tube Co., Frick Bldg., Pittsburgh, Pa.
Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland, O.
Wheeling Steel Corp., Wheeling, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

PILING (Pressure-Treated Wood)

Koppers Co., Wood Preserving Div., 300 Koppers Bldg., Pittsburgh, Pa.

PILLOW BLOCKS (Ball)

Ahlberg Bearing Co., 3015 W. 47th St., Chicago, Ill.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis, Ind.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
SKF Industries, Inc., Front St. & Erie Ave., Philadelphia, Pa.

PILLOW BLOCKS (Roller Bearing)

Ahlberg Bearing Co., 3015 W. 47th St., Chicago, Ill.
Dodge Manufacturing Corp., Mishawaka, Ind.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis, Ind.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
SKF Industries, Inc., Front St. & Erie Ave., Philadelphia, Pa.

PILLOW BOXES

Norma-Hoffmann Bearings Corp., Stamford, Conn.

PINIONS (Mill)

Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Horsburgh & Scott Co., The, 5112 Hamilton Ave., Cleveland, O.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
National-Erie Corp., Erie, Pa.
Simonds Gear & Mfg. Co., The, 25th St., Pittsburgh, Pa.
United Engineering & Foundry Co., First National Bank Bldg., Pittsburgh, Pa.

PINS (Taper)

Moltrup Steel Products Co., Beaver Falls, Pa.

PIPE (Aluminum, Brass, Bronze or Copper)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh, Pa.
American Brass Co., The, Waterbury, Conn.
Bridgeport Brass Co., Bridgeport, Conn.
Crane Co., 836 S. Michigan Ave., Chicago, Ill.
Lewin-Mathes Co., St. Louis, Mo.
Revere Copper & Brass Co., Inc., 230 Park Ave., New York City
Shenango-Penn Mold Co., 407 W. Third St., Dover, O.

PIPE (Cement Lined)

National Tube Co., Frick Bldg., Pittsburgh, Pa.

PIPE (Lead or Lead Lined)

National Lead Co., 111 Broadway, New York City

PIPE (Magnesium)

Dow Chemical Co., The, Midland, Mich.

PIPE (Rubber Lined)

American Hard Rubber Co., 11 Mercer St., New York City.

PIPE (Square and Rectangular)

National Tube Co., Frick Bldg., Pittsburgh, Pa.
Tubular Service Corp., 120 44th St., Brooklyn, N. Y.
Youngstown Sheet & Tube Co., The, Youngstown, O.

PIPE (Steel)

Allegheny Ludlum Steel Corp., 2319 Oliver Bldg., (22) Pittsburgh, Pa.
American Rolling Mill Co., The, 3271 Curtis St., Middletown, O.
Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Steel Co., San Francisco, Calif.
Crane Co., 836 So. Michigan Ave., Chicago, Ill.
Flori Pipe Co., The, Rud Bud & Bulwer Aves., St. Louis, Mo.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
National Tube Co., Frick Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Tubular Service Corp., 120 44th St., Brooklyn, N. Y.
Wheeling Steel Corp., Wheeling, W. Va.,
Youngstown Sheet & Tube Co., The, Youngstown, O.

PIPE (Steel, Fabricated)

Crane Co., 836 S. Michigan Ave., Chicago, Ill.
Flori Pipe Co., The, Rud Bud & Bulwer Aves., St. Louis, Mo.

PIPE BALLS

Youngstown Alloy Casting Corp., 103 E. Indianola Ave., Youngstown, O.

PIPE BENDING

Crane Co., 836 S. Michigan Ave., Chicago, Ill.
Flori Pipe Co., The, Rud Bud & Bulwer Aves., St. Louis, Mo.
Grinnell Co., Inc., Providence, R. I.
Tubular Service Corp., 120 44th St., Brooklyn, N. Y.

PIPE CUTTING AND THREADING MACHINERY

Aetna-Standard Engineering Co., The, Home Savings Bank Bldg., Youngstown, O.
Barnes, W. F. and John, Co., Rockford, Ill.
Landis Machine Co., Waynesboro, Pa.
Oster Mfg. Co., The, 2037 E. 61st St., Cleveland, O.
Taylor-Wilson Mfg. Co., 15 Thomson Ave., McKees Rocks, Pa.

PIPE FITTINGS

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh, Pa.
Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
Crane Co., 836 S. Michigan Ave., Chicago, Ill.
Flori Pipe Co., The, Rud Bud & Bulwer Aves., St. Louis, Mo.
Grinnell Co., Inc., Providence, R. I.
Oil Well Supply Co., Dallas, Texas.
Watson-Stillman Co., Roselle, N. J.
Worthington Pump & Machinery Corp., Harrison, N. J.

PIPE LINES (Riveted or Welded)

Bethlehem Steel Co., Bethlehem, Pa.

PIPE MILL MACHINERY

Aetna-Standard Engineering Co., The, Home Savings Bank Bldg., Youngstown, O.
American Engineering Co., 2484 Aramingo Ave., Philadelphia, Pa.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Taylor-Wilson Mfg. Co., 1200 Thomson Ave., McKees Rocks, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.
Yoder Co., The, W. 55th St. & Walworth Ave., Cleveland, O.

PIPE STRAIGHTENING MACHINERY

Aetna-Standard Engineering Co., The, Home Savings Bank Bldg., Youngstown, O.
Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia, Pa.
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.
Logemann Brothers Co., 3126 Burleigh St., Milwaukee, Wis.
Taylor-Wilson Mfg. Co., 1200 Thomson Ave., McKees Rocks, Pa.
United Engineering & Fdry, Co., First National Bank Bldg., Pittsburgh, Pa.

PIPE TOOLS

Detroit Tap & Tool Co., 8432 Butler St., Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Oster Mfg. Co., The, 2037 E. 61st St., Cleveland, O.

PIPING CONTRACTORS

Grinnell Co., Inc., Providence, R. I.
Power Piping Co., Beaver and Western Ave., Pittsburgh, Pa.

PISTON RINGS

American Hammered Piston Ring Div., Koppers Co., Baltimore, Md.

PISTON RODS

Bay City Co., W. 19th and Cranberry Sts., Erie, Pa.
Bliss & Laughlin, Inc., Harvey, Ill.
Heppenstall Co., Box S-12, 4620 Hatfield St., Pittsburgh, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Kropp Forge Co., 5301 W. Roosevelt Rd., Chicago, Ill.
Republic Steel Corp., Dept. ST, Cleveland, O.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.
Union Drawn Steel Div., Republic Steel Corp., Massillon, O.
Wyckoff Drawn Steel Co., 1st National Bank Bldg., Pittsburgh, Pa.

PLANERS

Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia, Pa.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.
Consolidated Machine Tool Corp., Winton & Blossom Rds., Rochester, N. Y.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Ohio Machine Tool Co., The, Kenton, O.
Sellers, William, & Co., Inc., 16th & Callowhill Sts., Philadelphia, Pa.

PLANT DISMANTLERS

Hetz Construction Co., Warren, O.

PLATE (Aluminum)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh, Pa.

PLATE CASTORS

Hyatt Bearings Div., General Motors Corp., Harrison, N. J.

PLATE LIFTING GRIPS

Downs Crane & Hoist Co., 540 W. Vernon Ave., Los Angeles, Calif.

PLATES (Magnesium)

Dow Chemical Co., The, Midland, Mich.

PLATES (Precision-Surface & Angle)

Smith Tool & Engineering Co., The, Sandusky Ave., Bucyrus, Ohio

PLATES (Sheared or Universal) (*Also Stainless)

*Alan Wood Steel Co., Conshohocken, Pa.
*Allegheny Ludlum Steel Corp., 2319 Oliver Bldg., (22) Pittsburgh, Pa.
*American Rolling Mill Co., The, 3271 Curtis St., Middletown, O.
*Bethlehem Steel Co., Bethlehem, Pa.
*Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Enterprise Galvanizing Co., 2525 E. Cumberland St., Philadelphia, Pa.
Granite City Steel Co., Granite City, Ill.
Ingersoll Steel & Disc Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago, Ill.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
International Nickel Co., Inc., The, 67 Wall St., New York City
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Levinson Steel Sales Co., The, 33 Pride St., Pittsburgh, Pa.
*Republic Steel Corp., Dept. ST, Cleveland, O.
*Ryerson, Jos. T., & Son, Inc., 16th and Rockwell Sts., Chicago, Ill.
*Scully Steel Products Co., 1316 Wabansia Ave., Chicago, Ill.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Worth Steel Co., Claymont, Del.
Youngstown Sheet & Tube Co., The, Youngstown, O.

PLATES (Stainless Clad)

Allegheny Ludlum Steel Corp., 2319 Oliver Bldg., (22), Pittsburgh, Pa.
Granite City Steel Co., Granite City, Ill.
Ingersoll Steel & Disc Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago, Ill.

PLATES (Surface & Angle)

Smith Tool & Engineering Co., The, 816 N. Wingert St., Bucyrus, O.

PLATES (Steel—Floor)—See FLOORING (Steel)

PLATES (Terne and Tin)—See TIN PLATE

PLATING EQUIPMENT

Chicago Wheel & Mfg. Co., Dept. ST, 1101 W. Monroe St., Chicago, Ill.
1101 W. Monroe St., Chicago, Ill.
MacDermid, Inc., Waterbury, Conn.
Udylite Corp., The, 1651 E. Grand Blvd., Detroit, Mich.

PLATING SUPPLIES

Pennsylvania Salt Mfg. Co., Widener Bldg., Philadelphia, Pa.
United Chromium, Inc., 51 E. 42nd St., New York City

PLUGS (Expansion)

Hubbard, M. D., Spring Co., 449 Central Ave., Pontiac, Mich.

PLUGS (Rolling Mill)

Youngstown Alloy Casting Corp., 103 E. Indianola Ave., Youngstown, O.

POLE LINE MATERIAL

Graybar Electric Co., 420 Lexington Ave., New York City
Oliver Iron & Steel Corp., S. 10th & Muriel Sts., Pittsburgh, Pa.

POLES (Tubular Steel)

National Tube Co., Frick Bldg., Pittsburgh, Pa.

PORTABLE TOOLS AND ACCESSORIES

Chicago Wheel & Manufacturing Co., Dept. ST, 1101 W. Monroe St., Chicago, Ill.
Graybar Electric Co., 420 Lexington Ave., New York City

POTENTIOMETERS

Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Foxboro Co., The, Foxboro, Mass.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia, Pa.

POTS (Case Hardening)

Pressed Steel Tank Co., 1461 S. 66th St., Milwaukee, Wis.

POTS (Lead)

Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.

POTS (Melting)

Kemp, C. M., Mfg. Co., 405 E. Oliver St., Baltimore, Md.

POWDERED METAL PRODUCTS

Mallory, P. R., & Co., 3029 E. Washington Ave., Indianapolis, Ind.

POWER PLANTS (Diesel, Gas Engine, Steam)

Pritchard, J. F., & Co., Dwight Bldg., Kansas City, Mo.
Ready-Power Co., The, 3826 Grand River Ave., Detroit, Mich.

POWER UNITS (Gasoline, Electric, for Industrial Trucks)

Ready-Power Co., The, 3842 Grand River Ave., Detroit, Mich.

PREHEATERS

Babcock & Wilcox Co., The, 85 Liberty St., New York City.
Salem Engineering Co., 714 S. Broadway, Salem, O.

PRESS BRAKES

Bliss, E. W. Co., 53rd St. & 2nd Ave., Brooklyn, N. Y.
Cincinnati Shaper Co., Elam and Garrard Sts., Cincinnati, O.
Cleveland Crane & Engineering Co., The, Steelweld Machinery Div., The, 1125 E. 283rd St., Wickliffe, O.
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.
Ferracute Machine Co., Bridgeton, N. J.

PRESSED METAL PARTS

Schnorr, C. H., and Co., 643 Railroad St., Springdale, Pa.
Stanley Works, The, Pressed Metal Div., New Britain, Conn.
Union Spring & Mfg. Co., New Kensington, Pa.

PRESSES

Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia, Pa.
Beatty Machine & Mfg. Co., Hammond, Ind.
Bliss, E. W., Co., 53rd St. & 2nd Ave., Brooklyn, N. Y.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.
Colonial Broach Co., P.O. Box No. 37, Harper Sta., Detroit, Mich.
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Co., Ltd., 195 Duke St., York, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Galland-Henning Manufacturing Co., 2747 S. 31st St., Milwaukee, Wis.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Logemann Brothers Co., 3126 Burleigh St., Milwaukee, Wis.
Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y.
Standard Machinery Co., Providence, R. I.
Streine Tool & Mfg. Co., New Bremen, O.
Taylor-Wilson Mfg. Co., 15 Thomson Ave., McKees Rocks, Pa.
Tomkins-Johnson Co., The, Dept. S, 611 N. Mechanic St., Jackson, Mich.
Watson-Stillman Co., Roselle, N. J.

PRESSES (Bending)

Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia, Pa.
Beatty Machine & Mfg. Co., Hammond, Ind.
Cleveland Crane & Engineering Co., The, Steelweld Machinery Div., The, 1125 E. 283rd St., Wickliffe, O.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Watson-Stillman Co., Roselle, N. J.
Zeh & Hahnemann Co., 56 Avenue A, Newark, N. J.

PRESSES (Extrusion)

Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia, Pa.
Beatty Machine & Mfg. Co., Hammond, Ind.
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Hydropress, Inc., 570 Lexington Ave., New York City.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Schloemann Engineering Corp., Empire Bldg., Pittsburgh, Pa.
Watson-Stillman Co., Roselle, N. J.

PRESSES (Forging)

Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia, Pa.
Bliss, E. W., Co., 53rd St. & 2nd Ave., Brooklyn, N. Y.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Co., Ltd., 195 Duke St., York, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Hydropress, Inc., 570 Lexington Ave., New York City.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Morgan Engineering Co., The, Alliance, O.
National Machinery Co., The, Tiffin, O.
Schloemann Engineering Corp., Empire Bldg., Pittsburgh, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.

PRESSES (Forming and Braking)

Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia, Pa.
Beatty Machine & Mfg. Co., Hammond, Ind.
Bliss, E. W., Co., 53rd St. & 2nd Ave., Brooklyn, N. Y.
Cincinnati Shaper Co., Elam and Garrard Sts., Cincinnati, O.
Cleveland Crane & Engineering Co., The, Steelweld Machinery Div., The, 1125 E. 283rd St., Wickliffe, O.
Farquhar, A. B., Co., Ltd., 195 Duke St., York, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Zen & Hahnemann Co., 56 Avenue A, Newark, N. J.

PRESSES (Hydraulic)

Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia, Pa.
Beatty Machine & Mfg. Co., Hammond, Ind.
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Bliss, E. W., Co., 53rd St. & 2nd Ave., Brooklyn, N. Y.
Chambersburg Engineering Co., Chambersburg, Pa.
Colonial Broach Co., P.O. Box No. 37, Harper Sta., Detroit, Mich.
Denison Engineering Co., The, 1163 Dublin Rd., Columbus, O.
Elmes, Chas. F., Engineering Works, 243 N Morgan St., Chicago, Ill.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Co., Ltd., 195 Duke St., York, Pa.
Galland-Henning Manufacturing Co., 2747 S. 31st St., Milwaukee, Wis.
Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill.
Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago, Ill.
Hydraulic Machinery Inc., The, 10421 Grand River Ave., Detroit, Mich.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Hydropress, Inc., 570 Lexington Ave., New York City.
Lempco Products Inc., Dept. SS, Bedford, O.
Logemann Brothers Co., 3126 Burleigh St., Milwaukee, Wis.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Morgan Engineering Co., The, Alliance, O.
National-Erie Corp., Erie, Pa.
Progressive Welder Co., 3050 E. Outer Drive, Detroit, Mich.
Schloemann Engineering Corp., Empire Bldg., Pittsburgh, Pa.
Watson-Stillman Co., Roselle, N. J.
Wood, R. D., Co., 400 Chestnut St., Philadelphia, Pa.
Wright Mfg. Div. of American Chain & Cable Co., Inc., York, Pa.

PRESSES (Pneumatic)

Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago, Ill.

PRESSES (Punching, Drawing, Coining, Blanking, etc.)

Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia, Pa.
Beatty Machine & Mfg. Co., Hammond, Ind.
Bliss, E. W., Co., 53rd St. & 2nd Ave., Brooklyn, N. Y.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.
Farquhar, A. B., Co., Ltd., 195 Duke St., York, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y.
Progressive Welder Co., 3050 E. Outer Drive, Detroit, Mich.
Zeh & Hahnemann Co., 56 Avenue A, Newark, N. J.

PRESSES (Riveting)

Ferracute Machine Co., Bridgeton, N. J.
Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill.
Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago, Ill.

PRESSES (Scrap Bundling and Baling)

Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia, Pa.
Galland-Henning Manufacturing Co., 2747 S. 31st St., Milwaukee, Wis.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Logemann Brothers Co., 3126 Burleigh St., Milwaukee, Wis.
Standard Machinery Co., Providence, R. I.

PRESSES (Stamping)

Bliss, E. W., Co., 53rd & 2nd Ave., Brooklyn, N. Y.
Ferracute Machine Co., Bridgeton N. J.
Matthews, Jas. H., & Co., 3942 Forbes St., Pittsburgh, Pa.
Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y.
Zeh & Hahnemann Co., 56 Avenue A, Newark, N. J.

PRESSES, BRIQUETTING (Turnings & Borings)

Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia, Pa.
Milwaukee Foundry Equipment Co., 3238 W. Pierce St., Milwaukee, Wis.
Watson-Stillman Co., Roselle, N. J.

PRESSURE VESSELS

Babcock & Wilcox Co., The, 85 Liberty St., New York City.
Scaife Co., Ann St. Oakmont, Pa.
Struthers Wells Corp., Titusville, Pa.

PRODUCER GAS SYSTEMS—See GAS PRODUCER PLANTS

PROJECTILE BANDS

Lewin-Mathes Co., St. Louis, Mo.

PUG MILLS (For Blast Furnaces and Sintering Plants)

Bailey, Wm. M., Co., 702 Magee Bldg., Pittsburgh, Pa.

PULLEYS (Magnetic)

Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.

PULVERIZERS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Pulverizer Co., 1539 Macklind Ave., St. Louis, Mo.
Babcock & Wilcox Co., The, 85 Liberty St., New York City.
Gruendler Crusher & Pulverizer Co., 2920-28 N. Market St., St. Louis, Mo.

PUMPS

Aldrich Pump Co., 2 Gordon St., Allentown, Pa.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.
Hydropress, Inc., 570 Lexington Ave., New York City.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Oil Well Supply Co., Dallas, Texas.
Roper, The Geo. D., Corp., Rockford, Ill.
Weinman Pump & Supply Co., The, 207-209 Blvd. of the Allies, Pittsburgh, Pa.
Worthington Pump & Machinery Corp., Harrison, N. J.

PUMPS (Boiler Feed)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Aldrich Pump Co., 2 Gordon St., Allentown, Pa.
Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.
Weinman Pump & Supply Co., The, 207-209 Blvd. of the Allies, Pittsburgh, Pa.
Worthington Pump & Machinery Corp., Harrison, N. J.

PUMPS (Centrifugal)

Aldrich Pump Co., 2 Gordon St., Allentown, Pa.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Brown & Sharpe Mfg. Co., Providence, R. I.
Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.
Weinman Pump & Supply Co., The, 207-209 Blvd. of the Allies, Pittsburgh, Pa.
Worthington Pump & Machinery Corp., Harrison, N. J.

PUMPS (Fuel Injection)

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, Mich.

PUMPS (High Pressure)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Hydropress, Inc., 570 Lexington Ave., New York City
Roper, Geo. D., Corp., The, Rockford, Ill.
Weinman Pump & Supply Co., The, 207-209 Blvd. of the Allies, Pittsburgh, Pa.

PUMPS (Hydraulic)

Aldrich Pump Co., 2 Gordon St., Allentown, Pa.
American Engineering Co., 2484 Aramingo Ave., Philadelphia, Pa.
Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.
Farquhar, A. B., Co., Ltd., York, Pa.
Galland-Henning Manufacturing Co., 2747 S. 31st St., Milwaukee, Wis.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Hydropress, Inc., 570 Lexington Ave., New York City.
Logemann Brothers Co., 3126 Burleigh St., Milwaukee, Wis.
Racine Tool & Machine Co., Racine, Wis.
Roper, The Geo. D., Corp., Rockford, Ill.
Schloemann Engineering Corp., Empire Bldg., Pittsburgh, Pa.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Watson-Stillman Co., Roselle, N. J.
Weinmann Pump & Supply Co., The, 207-209 Blvd. of the Allies, Pittsburgh, Pa.
Wood, R. D., Co., 400 Chestnut St., Philadelphia, Pa.
Worthington Pump & Machinery Corp., Harrison, N. J.

PUMPS (Reciprocating)

Aldrich Pump Co., 2 Gordon St., Allentown, Pa.
Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.
Weinman Pump & Supply Co., The, 207-209 Blvd. of the Allies, Pittsburgh, Pa.
Worthington Pump & Machinery Corp., Harrison, N. J.

PUMPS (Rotary)

Brown & Sharpe Mfg. Co., Providence, R. I.
Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.
Roper, The Geo. D., Corp., Rockford, Ill.
Weinman Pump & Supply Co., The, 207-209 Boulevard of the Allies, Pittsburgh, Pa.
Worthington Pump & Machinery Corp., Harrison, N. J.

PUMPS (Vacuum)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.
Worthington Pump & Machinery Corp., Harrison, N. J.

PUMPS (Vertical Turbine)

Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.
Layne & Bowler, Inc., Memphis, Tenn.
Watson-Stillman Co., Roselle, N. J.

PUNCHES (Multiple)

Beatty Machine & Mfg. Co., Hammond, Ind.
Cincinnati Shaper Co., Elam and Garrard Sts., Cincinati, O.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.
Consolidated Machine Tool Corp., Winton & Blossom Rds., Rochester, N. Y.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago, Ill.

PUNCHING AND SHEARING MACHINERY

Beatty Machine & Mfg. Co., Hammond, Ind.
Chambersburgh Engineering Co., Chambersburg, Pa.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.
Consolidated Machine Tool Corp., Winton & Blossom Rds., Rochester, N. Y.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago, Ill.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Morgan Engineering Co., The, Alliance, O.
Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y.
Thomas Machine Mfg. Co., Etna Branch P. O., Pittsburgh, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.
Watson-Stillman Co., Roselle, N. J.

PYROMETER TUBES

Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Carborundum Co., The, Niagara Falls, N. Y.
Norton Company, Worcester, Mass.

PYROMETERS

Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Brown Instrument Div. of Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia, Pa.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia, Pa.

RACKS (Steel, for Drums & Barrels)

Economy Engineering Co., 2657 W. Van Buren St., Chicago, Ill.

RAIL BREAKERS

National Roll & Foundry Co., The, Avonmore, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.

RAILS (New and Relaying)

Foster, L. B., Co., Inc., P. O. Box 1647, Pittsburgh, Pa.

RAILS (Steel)

Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Ryerson, Jos. T. & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Weirton Steel Co., Weirton, W. Va.

REAMERS

Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Co., Inc., 11141 E. 8 Mile Rd., Detroit, Mich.
Cleveland Twist Drill Co., The, 1242 E. 49th St., Cleveland, O.
Genesee Tool Co., Fenton, Mich.
Gisholt Machine Co., 1217 E. Washington Ave., Madison, Wis.
Greenfield Tap & Die Corp., Greenfield, Mass.

REBUILT EQUIPMENT

Albert, L., & Son, Whitehead Rd., Trenton, N. J.
Crawbuck, John D., Co., Empire Bldg., Pittsburgh, Pa.
Galbreath Machinery Co., Empire Bldg., Pittsburgh, Pa.
General Blower Co., 404 N. Peoria St., Chicago, Ill.
Iron & Steel Products, Inc., Hegewisch Sta., Chicago, Ill.
Lang Machinery Co., 28th & A.V.R.R., Pittsburgh, Pa.
Motor Repair & Mfg. Co., 1558 Hamilton Ave., Cleveland, O
Simmons Machine Tool Corp., 1850 N. Broadway, Albany, N. Y.
West Penn Machinery Co., 1208 House Bldg., Pittsburgh, Pa.

RECEIVERS

Pressed Steel Tank Co., 1461 S. 66th St., Milwaukee, Wis.
Scaife Co., Ann St., Oakmont, Pa.

RECORD SYSTEMS (Card)

Visible Index Co., 535 Fifth Ave., New York, N. Y.

RECORDERS (Combustion)

Hays Corp., The, 960 Eighth Ave., Michigan City, Ind.
Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.

RECORDERS (Pressure, Speed, Temperature, Time)

Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Brown Instrument Div. of Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia, Pa.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Hays Corp., The, Michigan City, Ind.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia, Pa.

RECTIFIERS (Dry Disc)

General Electric Co., Bridgeport, Conn.
Mallory, P. R., & Co., 3029 E. Washington Ave., Indianapolis, Ind.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

RECTIFIERS (Mercury Arc)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Co., Sec. H, 750-159, Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

REDUCTION GEARS

Foote Bros. Gear & Machine Co., 5301 S. Western Blvd., Chicago, Ill.
Horsburgh & Scott Co., The, 5112 Hamilton Ave., Cleveland, O.
James, D. O., Mfg. Co., 1140 W. Monroe St., Chicago, Ill.
Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia, Pa.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.
National-Erie Corp., Erie, Pa.
Philadelphia Gear Works, Erie Ave. & G St., Philadelphia, Pa.
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.
Westinghouse Electric & Mfg. Co., 200 McCandless Ave., Pittsburgh, Pa.
Worthington Pump & Machinery Corp., Harrison, N. J.

REFRACTORIES (Chrome)

Harbison-Walker Refractories Co., Farmers Bank Bldg., Pittsburgh, Pa.

REFRACTORIES (Dolomite)

Basic Refractories, Inc., Hanna Bldg., Cleveland, O.
Harbison-Walker Refractories Co., Farmers Bank Bldg., Pittsburgh, Pa.

REFRACTORIES (Fire Clay)

Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.
Eureka Fire Brick Works, 1100 B. F. Jones Law Bldg., Pittsburgh, Pa.
Globe Brick Co., The, East Liverpool, O.
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh, Pa.
Illinois Clay Products Co., 214 Barber Bldg., Joliet, Ill.
National Fireproofing Corp., 202 E. Ohio St., Pittsburgh, Pa.
Ramtite Co., The, Div. of the S. Obermayer Co., 2557 W 18th St., Chicago, Ill.

REFRACTORIES (For High Frequency Furnaces)

Ajax Electrothermic Corp., Ajax Park, Trenton, N. J.
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.
Carborundum Co., The, Perth Amboy, N. J.
Johns-Manville Corp., 22 E. 40th St., New York City
Norton Co., Worcester, Mass.
Titanium Alloy Mfg. Co., The, Niagara Falls, N. Y.

REFRACTORIES (Forsterite)

Harbison-Walker Refractories Co., Farmers Bank Bldg., Pittsburgh, Pa.

REFRACTORIES (High Alumina)

Carborundum Co., The, Niagara Falls, N. Y.
Harbison-Walker Refractories Co., Farmers Bank Bldg., Pittsburgh, Pa.

REFRACTORIES (Insulating)

Carborundum Co., The, Niagara Falls, N. Y.
Harbison-Walker Refractories Co., Farmers Bank Bldg., Pittsburgh, Pa.
Johns-Manville Corp., 22 E. 40th St., New York City

REFRACTORIES (Magnesia)

Basic Refractories, Hanna Bldg., Cleveland, O.
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh, Pa.

REFRACTORIES (Magnesite)

Basic Refractories, Inc., Hanna Bldg., Cleveland, O.
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh, Pa.,

REFRACTORIES (Plastic)

Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.
Basic Refractories, Hanna Bldg., Cleveland, O.
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh, Pa.,
Johns-Manville Corp., 22 E. 40th St., New York City
Ramtite Co., The, Div. of the S. Obermayer Co., 2557 W. 18th St., Chicago, Ill.

REFRACTORIES (Silica)

Carborundum Co., The, Niagara Falls, N. Y.
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh, Pa.

REFRACTORIES (Silicon Carbide)

Bay State Abrasive Products Co., Westboro, Mass.
Carborundum Co., The, Perth Amboy, N. J.
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh, Pa.
Norton Co., Worcester, Mass.
Ramtite Co., The, Div. of the S. Obermayer Co., 2557 W. 18th St., Chicago, Ill.

REFRACTORY CEMENT AND CONCRETE

Atlas Lumnite Cement Co., Dept. S., Chrysler Bldg., New York City.
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.
Carborundum Co., The, Niagara Falls, N. Y.
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh, Pa.,
Johns-Manville Corp., 22 E. 40th St., New York City.
National Fireproofing Corp., 202 E. Ohio St., Pittsburgh, Pa.
Quigley Co., Inc., 56 W. 45th St., New York City
Ramtite Co., The, Div. of the S. Obermayer Co., 2557 W. 18th St., Chicago, Ill.

REFRIGERATION EQUIPMENT (Industrial)

Kold-Hold Co., 444 North Grand Ave., Lansing, Mich.

REGULATORS (Pressure)

Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.
Electric Controller & Mfg. Co., The, 2700 E. 79th St., Cleveland, O.
Hays Corp., The, Michigan City, Ind.

REGULATORS (Temperature)

Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Brown Instrument Div. of Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia, Pa.
Foxboro Co., The 118 Neponset Ave., Foxboro, Mass.
Hays Corp., The, Michigan City, Ind.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia, Pa.

REGULATORS (Voltage)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Co., Sec. H, 750-159, Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

REINFORCEMENT FABRIC (Electric Welded)

American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Columbia Steel Co., San Francisco, Calif.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.

RELAYS (Magnetic)

Ward Leonard Electric Co., Mt. Vernon, N. Y.

RESISTORS (Alloy Grid or Wire Wound—Electric)

Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.
Electric Controller & Mfg. Co., The, 2698 E. 79th St., Cleveland, O.
General Electric Co., Sec. H, 750-159, Schenectady, N. Y.
Ward Leonard Electric Co., Mt. Vernon, N. Y.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

RESISTORS (Graphite Disc)

Allen-Bradley Co., 1320 S. 2nd St., Milwaukee, Wis.

RHEOSTATS

Electric Controller & Mfg. Co., The, 2700 E. 79th St., Cleveland, O.
Udylite Corp., The, 1651 E. Grand Blvd., Detroit, Mich.
Ward Leonard Electric Co., Mt. Vernon, N. Y.

RINGS (Aluminum, Brass, Bronze)

Shenango-Penn Mold Co., 407 W. Third St., Dover, O.

RINGS (Steel)

Bay City Forge Co., W. 19th and Cranberry Sts., Erie, Pa.
Heppenstall Co., Box S-12, 4620 Hatfield St., Pittsburgh, Pa.
King Fifth Wheel Co., 2915 No. Second St., Philadelphia, Pa.
Kropp Forge Co., 5301 W. Roosevelt Rd., Chicago, Ill.
Midvale Co., The, Nicetown, Philadelphia, Pa.
Moltrup Steel Products Co., Beaver Falls, Pa.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.

RINGS (Weldless) (*Also Stainless)

*Midvale Co., The, Nicetown, Philadelphia, Pa.

RIVETERS (Hydraulic—Portable and Stationary)

Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill.
Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago, Ill.

RIVETERS (Pneumatic)

Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill.
Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago, Ill.

RIVETING MACHINERY

Chambersburg Engineering Co., Chambersburg, Pa.
Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill.
Shuster, F. B., Co., Inc., New Haven, Conn.
Tomkins-Johnson Co., Dept. S, 611 N. Mechanic St., Jackson, Mich.
Wood, R. D., Co., 400 Chestnut St., Philadelphia, Pa.

RIVETS (*Also Stainless)

Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., 327 Carnegie Bldg., Pittsburgh, Pa.
Champion Rivet Co., The, 11200 Harvard Ave., Cleveland, O.
Harper, H. M., Co., The, 2646 Fletcher St., Chicago, Ill.
*Hassall, John, Inc., 402 Oakland St., Brooklyn, N. Y.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
*Oliver Iron & Steel Corp., S. 10th & Muriel Sts., Pittsburgh, Pa.
*Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland, O.
*Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Triplex Screw Co., The, 5317 Grant Ave., Cleveland, O.

RIVETS (Nonferrous)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh, Pa.
Harper, H. M., Co., The, 2646 Fletcher St., Chicago, Ill.

RODS (Alloy)

Ampco Metal, Inc., Dept. S-1, Milwaukee, Wis.
Bethlehem Steel Co., Bethlehem, Pa.
Bliss & Laughlin, Inc., Harvey, Ill.
Carpenter Steel Co., Reading, Pa.
Copperweld Steel Co., Warren, O.
International Nickel Co., Inc., The, 67 Wall St., New York City
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.

RODS (Aluminum, Brass, Bronze, Copper, Nickel, Silver, Silicon-Bronze)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh, Pa.
American Brass Co., The, Waterbury, Conn.
Bridgeport Brass Co., Bridgeport, Conn.
Bristol Brass Corp., The, Bristol, Conn.
Revere Copper & Brass Co., Inc., 230 Park Ave., New York City
Roebling's John A., Sons Co., Trenton, N. J.
Seymour Manufacturing Co., The, Seymour, Conn.
Titan Metal Mfg. Co., Bellefonte, Pa.

RODS (Drill)

Allegheny Ludlum Steel Corp., 2319 Oliver Bldg., (22) Pittsburgh, Pa.
Anchor Drawn Steel Co., Latrobe, Pa.
Carpenter Steel Co., Reading, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Kloster Steel Corp., 224-228 N. Justine St., Chicago, Ill.
Latrobe Electric Steel Co., Latrobe, Pa.
Monarch Steel Co., 545 W. McCarty St., Indianapolis, Ind.
Purdy, A. R., Co., Inc., 792 Greenwich St., New York City.

RODS (Iron and Steel)

Firth-Sterling Steel Co., McKeesport, Pa.
Kloster Steel Corp., 224-228 N. Justine St., Chicago, Ill.
Roebling's, John A., Sons Co., Trenton, N. J.

RODS (Magnesium)

Dow Chemical Co., The, Midland, Mich.

RODS (Phosphor Bronze)

Revere Copper & Brass Co., Inc., 230 Park Ave., New York City
Seymour Manufacturing Co., The, Seymour, Conn.

RODS (Rounds, Flats and Shapes) (*Also Stainless)

*Allegheny Ludlum Steel Corp., 2319 Oliver Bldg., (22) Pittsburgh, Pa.
*American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
*Copperweld Steel Co., Warren, O.
*Firth-Sterling Steel Co., McKeesport, Pa.
International Nickel Co., Inc., The, 67 Wall St., New York City
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
*Republic Steel Corp., Dept. ST, Cleveland, O.
Roebling's, John A., Sons Co., Trenton, N. J.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.
Washburn Wire Co., Phillipsdale, R. I.
Youngstown Sheet & Tube Co., The, Youngstown, O.

RODS (Welding)—See WELDING RODS

RODS (Wire)—See WIRE PRODUCTS

ROLL COOLERS (Internal, Water)

Hunt, C. B., & Son, Salem, Ohio

ROLL FORMING MACHINES

Etna Machine Co., The, 3400 Maplewood Ave., Toledo, O.
Kane & Roach, Inc., Niagara & Shonnard Sts., Syracuse, N. Y.
Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y.
Yoder Co., The, W. 55th St. & Walworth Ave., Cleveland, O.

ROLL HEATERS—See HEATERS (Electric Roll)

ROLLING DOORS & SHUTTERS—See DOORS AND SHUTTERS

ROLLING MILL BEARINGS—See BEARINGS (Rolling Mill)

ROLLING MILL EQUIPMENT

Aetna-Standard Engineering Co., The, Home Savings Bank Bldg., Youngstown, O.
Alliance Machine Co., The, Alliance, O.
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Cold Metal Products Co., The, 2131 Wilson Ave., Youngstown, O.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Hyde Park Fdry. & Mach. Co., Hyde Park, Pa.
Hydropress, Inc., 570 Lexington Ave., New York City.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Mackintosh-Hemphill Co., 9th and Bingham Sts., Pittsburgh, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Morgan Construction Co., Worcester, Mass.
Morgan Engineering Co., The, Alliance, O.
National Roll & Foundry Co., The, Avonmore, Pa.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Streine Tool & Mfg. Co., New Bremen, O.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.
Wean Engineering Co., Warren, O.

ROLLING MILL ENGINEERS (Consulting and Contracting)

Hydropress, Inc., 570 Lexington Ave., New York City.
Schloemann Engineering Corp., Empire Bldg., Pittsburgh, Pa.

ROLLING MILL MACHINERY (Used)

Foster, Frank B., Oliver Bldg., Pittsburgh, Pa.

ROLLING MILL TABLES

Hydropress, Inc., 570 Lexington Ave., New York City.
Schloemann Engineering Corp., Empire Bldg., Pittsburgh, Pa.

ROLLS (Bending and Straightening)

Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia, Pa.
Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago, Ill.
Webb Corp., The, Webb City, Mo.

ROLLS (Iron and Steel)

Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Hyde Park Fdry. and Machine Co., Hyde Park, Pa.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Mackintosh-Hemphill Co., 9th and Bingham Sts., Pittsburgh, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Midvale Co., The, Nicetown, Philadelphia, Pa.
National Roll & Fdry. Co., The, Avonmore, Pa.
Ohio Steel Fdry. Co., Lima, O.-Springfield, O.
Pittsburgh Rolls Div., Blaw-Knox Co., Pittsburgh, Pa.
Pittsburgh Steel Foundry Co., Glassport, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.

ROLLS (Sand and Chilled)

Aetna-Standard Engineering Co., The, Home Savings Bank Bldg., Youngstown, O.
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Hyde Park Fdry. & Mach. Co., Hyde Park, Pa.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Mackintosh-Hemphill Co., 9th and Bingham Sts., Pittsburgh, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
National Roll & Foundry Co., The, Avonmore, Pa.
Ohio Steel Fdry. Co., Lima, O.-Springfield, O.
Pittsburgh Rolls Div. of Blaw-Knox Co., Pittsburgh, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.

ROLLS (Tinning Machine)

American Shear Knife Co., P.O. Box 355, Homestead, Pa.

ROOFING, SIDING & FLASHING

Globe Iron Roofing & Corrugating Co., The, Newport, Ky.
Johns-Manville Corp., 22 E. 40th St., New York City.
Newport Rolling Mill Co., The, Newport, Ky.
Protected Steel Products Co., 33 Pride St., Pittsburgh, Pa.

ROOFING AND SIDING (Corrugated and Plain)

American Rolling Mill Co., The, 3271 Curtis St., Middletown, O.
Bethlehem Steel Co., Bethlehem, Pa.
Carey, Philip, Mfg. Co., The, Lockland, Cincinnati, O.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Granite City Steel Co., Granite City, Ill.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
New Jersey Zinc Co., 160 Front St., New York City.
Republic Steel Corp., Dept. ST, Cleveland, O.
Robertson, H. H., Co., Farmers Bank Bldg., Pittsburgh, Pa.
Ryerson, Jos. T., & Sons, Inc., 16th and Rockwell Sts., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Weirton Steel Co., Weirton, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

ROOFING (Plastic and Liquid)

Carey, Philip, Mfg. Co., The, Lockland, Cincinnati, O.
Koppers Co., Tar & Chemical Div., 300 Koppers Bldg., Pittsburgh, Pa.

RUBBER LINING (Hard and Soft)

American Hard Rubber Co., 11 Mercer St., New York City.

RUST PREVENTIVES

Alrose Chemical Co., 180 Mill St., Providence, R. I.
Dearborn Chemical Co., 310 S. Michigan Ave., Chicago, Ill.
International Rustproof Corp., 12507 Plover Ave., Lakewood, O.
Koppers Co., Tar & Chemical Div., 300 Koppers Bldg., Pittsburgh, Pa.
Smith Oil & Refining Co., Rockford, Ill.

RUST PROOFING PROCESSES AND EQUIPMENT

Alrose Chemical Co., 180 Mill St., Providence, R. I.
Detroit Rex Products Co., 13029 Hillview Ave., Detroit, Mich.
Enterprise Galvanizing Co., 2525 E. Cumberland St., Philadelphia, Pa.
International Rustproof Corp., 12507 Plover Ave., Lakewood, O.
Udylite Corp., The, 1651 E. Grand Blvd., Detroit, Mich.

SAFE ENDS (Boiler Tube)

National Tube Co., Frick Bldg., Pittsburgh, Pa.
Tubular Service Corp., 120 44th St., Brooklyn, N. Y.

SAFETY DEVICES (Electric)

Electric Controller & Mfg. Co., The, 2700 E. 79th St., Cleveland, O.
Lintern Corp., The, Lincoln Ave., Berea, O.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

SAFETY EQUIPMENT

Kimball Safety Products Co., 7314 Wade Park Ave., Cleveland, O.

SALT TABLETS

Morton Salt Co., 310 So. Michigan Ave., Chicago, Ill.

SAND BLAST EQUIPMENT

Pangborn Corporation, Hagerstown, Md.
Vapor Blast Mfg. Co., 333 S. 16th St., Milwaukee, Wis.

SAND CONDITIONING AND PREPARING MACHINERY

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Foundry Equipment Co., The, 509 S. Byrkit St., Mishawaka, Ind.
Bartlett, C. O., & Snow Co., 6200 Harvard Ave., Cleveland, O.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Vapor Blast Mfg. Co., 333 S. 16th St., Milwaukee, Wis.

SANDERS (Traction, Crane)

Lintern Corp., The, Lincoln Ave., Berea, O.

SAWING MACHINES (Contour)

Continental Machines, Inc., 1324 S. Washington Ave., Minneapolis, Minn.

SAWING MACHINES (Hack)

Armstrong-Blum Mfg. Co., 5700 Bloomingdale Ave., Chicago, Ill.
Racine Tool & Machine Co., Racine, Wis.

SAWING MACHINES (Hot and Cold)

Armstrong-Blum Mfg. Co., 5700 Bloomingdale Ave., Chicago, Ill.
Consolidated Machine Tool Corp., Winton & Blossom Rds., Rochester, N. Y.
Morgan Engineering Co., The, Alliance, O.
Motch & Merryweather Machinery Co., Penton Bldg., Cleveland, O.
Racine Tool & Machine Co., Racine, Wis.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.
Wells Mfg. Co., Three Rivers, Mich.

SAWS (Band—Metal Cutting)

Armstrong-Blum Mfg. Co., 5700 Bloomingdale Ave., Chicago, Ill.
Atkins, E. C., & Co., 427 S. Illinois St., Indianapolis, Ind.
Continental Machines, Inc., 1324 S. Washington Ave., Minneapolis, Minn.
Disston, Henry, & Sons, Inc., 1226 Tacony, Philadelphia, Pa.
Huther Bros. Saw & Mfg. Co., 1290 University Ave., Rochester, N. Y.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Walker Turner Co., Inc., 50102 Berckman St., Plainfield, N. J.
Wells Mfg. Co., Three Rivers, Mich.

SAWS (Hack)

Armstrong-Blum Mfg. Co., 5700 Bloomingdale Ave., Chicago, Ill.
Atkins, E. C., & Co., 427 S. Illinois St., Indianapolis, Ind.
Disston, Henry, & Sons, Inc., 1226 Tacony, Philadelphia, Pa.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

SAWS (Hot & Cold)

Atkins, E. C., & Co., 402 S. Illinois St., Indianapolis, Ind.
Huther Bros. Saw Mfg. Co., 1290 University Ave., Rochester, N. Y.
Motch & Merryweather Machinery Co., Penton Bldg., Cleveland, O.

SAWS (Inserted Tooth, Cold)

Disston, Henry, & Sons, Inc., 1226 Tacony, Philadelphia, Pa.

SAWS (Inserted Tooth, Cold)—Con.
Huther Bros. Saw Mfg. Co., 1290 University Ave., Rochester, N. Y.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

SAWS (Metal Cutting)
Armstrong-Blum Mfg. Co., 5737 Bloomingdale Ave., Chicago, Ill.
Atkins, E. C., & Co., 402 S. Illinois St., Indianapolis, Ind.
Brown & Sharpe Mfg. Co., Providence, R. I.
Continental Machines, Inc., 1324 S. Washington Ave., Minneapolis, Minn.
Disston, Henry, & Sons, Inc., 1226 Tacony, Philadelphia, Pa.
Genesee Tool Co., Fenton, Mich.
Motch & Merryweather Machinery Co., Penton Bldg., Cleveland, O.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Walker-Turner Co., Inc., 5013 Berckman St., Plainfield, N. J.
Wells Mfg. Co., Three Rivers, Mich.
Youngstown Sheet & Tube Co., The, Youngstown, O.

SAWS (Segmental)
Atkins, E. C., & Co., 427 S. Illinois St., Indianapolis, Ind.
Disston, Henry, & Sons, Inc., 1226 Tacony, Philadelphia, Pa.
Motch & Merryweather Machinery Co., Penton Bldg., Cleveland, O.

SCAFFOLDING (Tubular)
Dravo Corp. (Machinery Div.) 300 Penn Ave., Pittsburgh, Pa.

SCALES
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.

SCALES (Dial & Recording)
Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.

SCALES (Laboratory)
Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.

SCALES (Monorail)
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., 1125 E. 283rd St., Wickliffe, O.
Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.

SCRAP BALING PRESSES—See PRESSES (Scrap Bundling and Baling)

SCREENS (Vibrating)
Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia, Pa.

SCREENS AND SIEVES
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Bartlett, C. O., & Snow Co., 6200 Harvard Ave., Cleveland, O.
Chicago Perforating Co., 2443 W. 24th Pl., Chicago, Ill.
Erdle Perforating Co., 171 York St., Rochester, N. Y.
Harrington & King Perforating Co., 5634 Fillmore St., Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.
Koppers Co., Engineering & Construction Div., 901 Koppers Bldg., Pittsburgh, Pa.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.

SCREW EXTRACTORS
Greenfield Tap & Die Corp., Greenfield, Mass.

SCREW MACHINE PRODUCTS
Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh, Pa.
Doyle, The, J. E., Co., 1220 West 6th St., Cleveland, O.
Hindley Mfg. Co., Valley Falls, R. I.
National Acme Co., The, 170 E. 131st St., Cleveland, O.
Titan Metal Mfg. Co., Bellefonte, Pa.

SCREW MACHINES (Automatic, Single and Multiple Spindle)
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Machine Co., 2269 Ashland Ave., Cleveland, O.
Cone Automatic Machine Co., Inc., Windsor, Vt.
Greenlee Bros. & Co., Rockford, Ill.
National Acme Co., The, 170 E. 131st St., Cleveland, O.
Oster Mfg. Co., The, 2037 E. 61st St., Cleveland, O.
Sheffield Corp., The, 721 Springfield St., Dayton, O.

SCREW PLATES
Greenfield Tap & Die Corp., Greenfield, Mass.

SCREW STOCK—See STEEL (Screw Stock)

SCREWS (Cap, Set, Safety-Set)
Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Cleveland Cap Screw Co., 2917 E. 79th St., Cleveland, O.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
National Acme Co., The, 170 E. 131st St., Cleveland, O.
Oliver Iron & Steel Corp., S. 10th & Muriel Sts., Pittsburgh, Pa.
Parker-Kalon Corp., 194-200 Varick St., New York City.
Triplex Screw Co., 5341 Grant Ave., Cleveland, O.

SCREWS (Cold Headed)
American Screw Co., Providence, R. I.
Central Screw Company, 3517 Shields Ave., Chicago, Ill.
Cleveland Cap Screw Co., 2917 E. 79th St., Cleveland, O.
Hassall, John, Inc., 402 Oakland St., Brooklyn, N. Y.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
Oliver Iron & Steel Corp., S. 10th & Muriel Sts., Pittsburgh, Pa.

SCREWS (Conveyor)
Lee Spring Co. Inc., 30 Main St., Brooklyn. N. Y.
Link-Belt Co., 2410 W. 18th St., Chicago, Ill.

SCREWS (Hardened Metallic Drive)
American Screw Company, Providence, R. I.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
Parker-Kalon Corp., 194-200 Varick St., New York City.

SCREWS (Hardened Self-Tapping)
American Screw Co., Providence, R. I.
Central Screw Company, 3517 Shields Ave., Chicago, Ill.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
Parker-Kalon Corp., 194-200 Varick St., New York City.

SCREWS (Machine)
American Screw Co., Providence, R. I.
Central Screw Company, 3517 Shields Ave., Chicago, Ill.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
Triplex Screw Co., 5341 Grant Ave., Cleveland, O.

SCREWS (Machine, Recessed Head)
American Screw Co., Providence, R. I.
Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Co., Euclid, O.
Continental Screw Co., New Bedford, Mass.
Corbin Screw Corp., New Britain, Conn.
International Screw Co., Detroit, Mich.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
National Screw & Mfg. Co., 2440 E. 75th St., Cleveland, O.
New England Screw Co., Keene, N. H.
Parker-Kalon Corp., 194-200 Varick St., New York City.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Mfg. Co., 5700 Roosevelt Rd., Chicago, Ill.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Mfg. Co., Waterbury, Conn.

SCREWS (Nonferrous and Stainless)
Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh, Pa.
American Screw Co., Providence, R. I.
Harper, H. M., Co., The, 2646 Fletcher St., Chicago, Ill.
Hassall, John, Inc., 402 Oakland St., Brooklyn, N. Y.

SCREWS (Sheet Metal, Recessed Head)
American Screw Co., Providence, R. I.
Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Co., Euclid, O.
Continental Screw Co., New Bedford, Mass.
Corbin Screw Corp., New Britain, Conn.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
National Screw & Mfg. Co., 2440 E. 75th St., Cleveland, O.
Parker-Kalon Corp., 194-200 Varick St., New York City.
Pheoll Mfg. Co., 5700 Roosevelt Rd., Chicago, Ill.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Shakeproof Lock Washer Co., Chicago, Ill.

SCREWS (Socket, Cold Forged)
Parker-Kalon Corp., 194-200 Varick St., New York City.

SCREWS (Thread Cutting)
American Screw Co., Providence, R. I.
Parker-Kalon Corp., 194-200 Varick St., New York City

SCREWS (Thumb)
Central Screw Company, 3517 Shields Ave., Chicago, Ill.
Parker-Kalon Corp., 194-200 Varick St., New York City.

SCREWS (Wood, Recessed Head)
Bristol Co., Waterbury, Conn.
Chandler Products Co., Euclid, O.
Continental Screw Co., New Bedford, Mass.
Corbin Screw Corp., New Britain, Conn.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
National Screw & Mfg. Co., 2440 E. 75th St., Cleveland, O.
Parker, Charles, Co., The, Meriden, Conn.
Pheoll Mfg. Co., 5700 Roosevelt Rd., Chicago, Ill.
Southington Hardware, Mfg. Co., Southington, Conn.
Whitney Screw Co., Nashua, N. H.

SCRUBBERS (Gas or Air)—see GAS SCRUBBERS

SEALS (Oil and Grease)
Chicago Rawhide Mfg. Co., 900 Alpine Ave., Detroit, Mich.

SEAMLESS STEEL TUBING—See TUBING (Seamless Steel)

SEPARATORS (Magnetic)
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.
Electric Controller & Mfg. Co., The, 2700 E. 79th St., Cleveland, O.
Frantz Co., Inc., S. G., 161 Grand St., New York City.
Ohio Electric Mfg. Co., The, 5906 Maurice Ave., Cleveland, O.

SHAFT HANGERS—See HANGERS (Shaft)

SHAFTING
Bliss & Laughlin, Inc., Harvey, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Chicago, Ill.
Moltrup Steel Products Co., Beaver Falls, Pa.
Monarch Steel Co., 545 W. McCarty St., Indianapolis, Ind.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Scully Steel Products Co., 1316 Wabansia Ave., Chicago, Ill.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.
Union Drawn Steel Div., Republic Steel Corp., Massillon, O.
Wyckoff Drawn Steel Co., First National Bank Bldg., Pittsburgh, Pa.

SHAFTING (Flexible)
Walker-Turner Co., Inc., 5013 Berckman St., Plainfield, N. J.

SHAPERS
Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia, Pa.
Cincinnati Shaper Co., Garrard and Elam Sts., Cincinnati, O.
Lempco Products Inc., Dept. SS, Bedford, O.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Ohio Machine Tool Co., The, Kenton, O.

SHAPES (Brass, Bronze, Nickel Silver)
Titan Metal Mfg. Co., Bellefonte, Pa.

SHAPES (Magnesium)
Dow Chemical Co., The, Midland, Mich.

SHAPES, SPECIAL (Magnesium)
Dow Chemical Co., The, Midland, Mich.

SHAPES (Steel)—See STEEL (Structural)

SHAPES, SPECIAL (Steel)
Bliss & Laughlin, Inc., Harvey, Ill.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
Monarch Steel Co., 545 W. McCarty St., Indianapolis, Ind.
Pressed Steel Tank Co., 1461 S. 66th St., Milwaukee, Wis.
Roebling's, John A., Sons Co., Trenton, N. J.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Union Drawn Steel Div., Republic Steel Corp., Massillon, O.
Wyckoff Drawn Steel Co., First National Bank Bldg., Pittsburgh, Pa.

SHEAR BLADES
American Shear Knife Co., P.O. Box 355, Homestead, Pa.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.
Disston, Henry, & Sons, Inc., 1226 Tacony, Philadelphia, Pa.
Heppenstall Co., Box S-12, 4620 Hatfield St., Pittsburgh, Pa.
Ohio Knife Co., Dreman Ave. & B. & O. R.R., Cincinnati, O.
Wapakoneta Machine Co., Wapakoneta, O.

SHEARS
Aetna-Standard Engineering Co., The, Home Savings Bank Bldg., Youngstown, O.
Beatty Machine & Mfg. Co., Hammond, Ind.
Bliss, E. W., Co., 53rd St. & 2nd Ave., Brooklyn, N. Y.
Cincinnati Shaper Co., Garrard and Elam Sts., Cincinnati, O.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.

SHEARS—Con.

Consolidated Machine Tool Corp., Winton & Blossom Rds., Rochester, N. Y.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Hallden Machine Co., The, Thomaston, Conn.
Hyde Park Fdry. & Mach. Co., Hyde Park, Pa.
Lewis Fdry. & Mach. Div. of Blaw-Knox Co., Pittsburgh, Pa.
Mesta Machine Co., P. O. Box 1400, Pittsburgh, Pa.
Morgan Engineering Co., The, Alliance, O.
Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y.
O'Neil-Irwin Mfg. Co., 304 8th Ave. S. Minneapolis, Minn.
Streine Tool & Mfg. Co., New Bremen, O.
Thomas Machine Mfg. Co., Etna Branch P. O., Pittsburgh, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.
Watson-Stillman Co., Roselle, N. J.

SHEARS, ROTARY (Slitting, Beveling, Circling, Flanging)

Consolidated Machine Tool Corp., Winton & Blossom Rds., Rochester, N. Y.
Hydropress, Inc., 570 Lexington Ave., New York City.
Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y.

SHEET BARS

Andrews Steel Co., The, Newport, Ky.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Youngstown Sheet & Tube Co., The, Youngstown, O.

SHEET LIFTERS AND CARRIERS

American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Cullen-Friestedt Co., 1308 S. Kilbourn Ave., Chicago, Ill.
Hyde Park Fdry. & Mach. Co., Hyde Park, Pa.
J-B Engineering Sales Co., 3100 East St., New Haven, Conn.

SHEET METAL PRODUCTS—See STAMPINGS

SHEET METAL WORKERS MACHINES

Cincinnati Shaper Co., Elam and Garrard Sts., Cincinnati, O.
Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y.
Streine Tool & Mfg. Co., New Bremen, O.

SHEET STEEL PILING (New and Used)

American Rolling Mill Co., The, 3271 Curtis St., Middletown, O.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Foster, L. B., Co., Inc., P. O. Box 1647, Pittsburgh, Pa.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.

SHEETS (Acid Resisting)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh, Pa.
International Nickel Co., Inc., The, 67 Wall St., New York City.

SHEETS (Aluminum)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh, Pa.

SHEETS (Black)

Alan Wood Steel Co., Conshohocken, Pa.
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Carnegie-Illinois Steel Corp., 327 Carnegie Bldg., Pittsburgh, Pa.
Columbia Steel Co., Russ Bldg., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Granite City Steel Co., Granite City, Ill.
Great Lakes Steel Corp., Ecorse, Detroit, Mich.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Newport Rolling Mill Co., The, Newport, Ky.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Superior Sheet Steel Div., Continental Steel Corp., Canton, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Youngstown Sheet & Tube Co., The, Youngstown, O.

SHEETS (Brass, Bronze, Copper, Nickel Silver, Silicon-Bronze)

American Brass Co., The, Waterbury, Conn.
Bridgeport Brass Co., Bridgeport, Conn.
Bristol Brass Corp., The, Bristol, Conn.
Revere Copper & Brass Co., Inc., 230 Park Ave., New York City

SHEETS (Corrugated)

American Rolling Mill Co., The, 3271 Curtis St., Middletown, O.
Apollo Steel Co., 2243-2244 Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Globe Iron Roofing & Corrugating Co., The, Newport, Ky.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Newport Rolling Mill Co., The, Newport, Ky.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Weirton Steel Co., Weirton, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

SHEETS (Deep Drawing and Stamping)

Alan Wood Steel Co., Conshohocken, Pa.
Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh, Pa.
American Rolling Mill Co., The, 3271 Curtis St., Middletown, O.
Apollo Steel Co., 2243-2244 Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Granite City Steel Co., Granite City, Ill.
Great Lakes Steel Corp., Ecorse, Detroit, Mich.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Newport Rolling Mill Co., The, Newport, Ky.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Weirton Steel Co., Weirton, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

SHEETS (Electrical)

Allegheny Ludlum Steel Corp., 2319, Oliver Bldg., (22), Pittsburgh, Pa.
American Rolling Mill Co., The, 3271 Curtis St., Middletown, O.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Granite City Steel Co., Granite City, Ill.
Ingersoll Steel & Disc. Div., Borg-warner Corp., 310 S. Michigan Ave., Chicago, Ill.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Newport Rolling Mill Co., The, Newport, Ky.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Wheeling Steel Corp., Wheeling, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

SHEETS (Galvanized)

American Rolling Mill Co., The 3271 Curtis St., Middletown, O.
Apollo Steel Co., 2243-2244 Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Granite City Steel Co., Granite City, Ill.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Newport Rolling Mill Co., The, Newport, Ky.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Scully Steel Products Co., 1316 Wabansia Ave., Chicago, Ill.
Superior Sheet Steel Div., Continental Steel Corp., Canton, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Wheeling Steel Corp., Wheeling, W. Va.
Weirton Steel Co., Weirton, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

SHEETS (Hot Rolled and Hot Rolled Annealed)

Alan Wood Steel Co., Conshohocken, Pa.
American Rolling Mill Co., The, 3271 Curtis St., Middletown, O.
Apollo Steel Co., 2243-2244 Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Disston, Henry, & Sons, Inc., 1226 Tacony, Philadelphia, Pa.
Granite City Steel Co., Granite City, Ill.
Great Lakes Steel Corp., Ecorse, Detroit, Mich.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Levinson Steel Sales Co., The, 33 Pride St., Pittsburgh, Pa.
Newport Rolling Mill Co., The, Newport, Ky.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Scully Steel Products Co., 1316 Wabansia Ave., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Wheeling Steel Corp., Wheeling, W. Va.
Weirton Steel Co., Weirton, W. Va.
Worth Steel Co., Claymont, Del.
Youngstown Sheet & Tube Co., The, Youngstown, O.

SHEETS (Lead Coated)

Continental Steel Corp., Kokomo, Ind.
National Lead Co., 111 Broadway, New York City
Superior Sheet Steel Div., Continental Steel Corp., Canton, O.

SHEETS (Long Terne)

American Rolling Mill Co., The, 3271 Curtis St., Middletown, O.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Continental Steel Corp., Kokomo, Ind.
Newport Rolling Mill Co., The, Newport, Ky.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Superior Sheet Steel Div., Continental Steel Corp., Canton, O.
Weirton Steel Co., Weirton, W. Va.
Wheeling Steel Corp., Wheeling, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

SHEETS (Magnesium)

Dow Chemical Co., The, Midland, Mich.

SHEETS (Manganese Steel)

Taylor-Wharton Iron & Steel Co., High Bridge, N. J.

SHEETS (Nickel, Nickel Silver)

International Nickel Co., Inc., The, 67 Wall St., New York City
Revere Copper & Brass Co., Inc., 230 Park Ave., New York City
Seymour Manufacturing Co., The, Seymour, Conn.

SHEETS (Perforated)

Harrington & King Perforating Co., 5634 Fillmore St., Chicago, Ill.

SHEETS (Phosphor Bronze)

Bridgeport Brass Co., Bridgeport, Conn.
Revere Copper & Brass Co., Inc., 230 Park Ave., New York City
Seymour Manufacturing Co., The, Seymour, Conn.

SHEETS (Reinforced)

Erdle Perforating Co., 171 York St., Rochester, N. Y.

SHEETS (Roofing)—See ROOFING AND SIDING (Corrugated and Plain)

SHEETS (Stainless)

Allegheny Ludlum Steel Corp., 2319, Oliver Bldg., (22), Pittsburgh, Pa.
American Rolling Mill Co., The, 3271 Curtis St., Middletown, O.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Republic Steel Corp., Massillon, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.

SHEETS (Stainless Clad)

Allegheny Ludlum Steel Corp., 2319 Oliver Bldg. (22), Pittsburgh, Pa.
Granite City Steel Co., Granite City, Ill.
Ingersoll Steel & Disc Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago, Ill.

SHEETS (Tin)—See TIN PLATE

SHEETS (Tin Mill Black)

Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Granite City Steel Co., Granite City, Ill.

SHEETS (Tin Mill Black)—Con.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Newport Rolling Mill Co., The, Newport, Ky.
Republic Steel Corp., Dept. ST, Cleveland, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Weirton Steel Co., Weirton, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

SHEETS—HIGH FINISH (Automobile, Metal Furniture, Enameling)
Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh, Pa.
American Rolling Mill Co., The, 3271 Curtis St., Middletown, O.
Apollo Steel Co., 2243-2244 Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Great Lakes Steel Corp., Ecorse, Detroit, Mich.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Wheeling Steel Corp., Wheeling, W. Va.
Weirton Steel Co., Weirton, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

SHELL BANDS (Rotating)
Lewin-Mathes Co., St. Louis, Mo.

SHELLS (Seamless Drawn)
Pressed Steel Tank Co., 1461 S. 66th St., Milwaukee, Wis.

SHIMS (Laminated)
Laminated Shim Co., Inc., 87 Union St., Glenbrook, Conn.

SHOVELS (Power)
Northwest Engineering Co., 28 E. Jackson Blvd., Chicago, Ill.

SIEVES—See SCREENS AND SIEVES

SIGNALING & INTERCOMMUNICATION EQUIPMENT
Graybar Electric Co., 420 Lexington Ave., New York City.

SIGNS (Metal)
Webb Corp., The, Webb City, Mo.

SILICO-MANGANESE
Electro Metallurgical Co., 30 E. 42nd St., New York City.
Samuel, Frank & Co., Inc., Harrison Bldg., Philadelphia, Pa.

SILICON BRONZE
Bridgeport Brass Co., Bridgeport, Conn.

SILICON METAL AND ALLOYS
Electro Metallurgical Co., 30 E. 42nd St., New York City.
Revere Copper & Brass, Inc., 230 Park Ave., New York City.
Vanadium Corp. of America, 420 Lexington Ave., New York City.

SKELP (Steel)
Alan Wood Steel Co., Conshohocken, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.

SLAG GRANULATING MACHINES (Blast Furnace and Open Hearth)
Brosius, Edgar E., Co., Sharpsburg Branch, Pittsburgh, Pa.

SLEEVES (Piston, Pump & Shaft)
Shenango-Penn Mold Co., 407 W. Third St., Dover, O.

SLITTERS
Cowles Tool Co., 2086 W. 110th St., Cleveland, O.
Ohio Knife Co., Dremen Ave. & B. & O. R.R., Cincinnati, O.
Wapakoneta Machine Co., The, Wapakoneta, Ohio

SMALL TOOLS
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., The, 1242 E. 49th St., Cleveland, O.

SOAKING PITS
Amsler-Morton Co., The, Fulton Bldg., Pittsburgh, Pa.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Surface Combustion Div. of General Properties Co., Inc., 2375 Dorr St., Toledo, O.

SOLDER
Kester Solder Co., 4222 Wrightwood Ave., Chicago, Ill.
National Lead Co., 111 Broadway, New York City

SOLDERING EQUIPMENT
Lepel High Frequency Laboratories Inc., 39 W. 60th St., New York City.

SOLENOIDS (Electric)
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.

SOLVENT (Degreasing)
Detroit Rex Products Co., 13029 Hillview Ave., Detroit, Mich.
Pennsylvania Salt Mfg. Co., Dept. S. Pennsalt Cleaner Div., Philadelphia, Pa.

SPACING TABLES
Thomas Machine Mfg. Co., Etna Branch P. O., Pittsburgh, Pa.

SPECIAL MACHINERY—See MACHINERY (Special)

SPEED REDUCERS
Cleveland Worm & Gear Co., 3270 E. 80th St., Cleveland, O.
Foote, Brad, Gear Works, Cicero, Ill.
Foote Bros. Gear & Machine Co., 5301 S. Western Blvd., Chicago, Ill.
Grant Gear Works, 2nd & B. Sts., Boston, Mass.
Horsburgh & Scott Co., The, 5112 Hamilton Ave., Cleveland, O.
James, D. O., Mfg. Co., 1140 W. Monroe St., Chicago, Ill.
Jones, W. A., Fdry. & Mach. Co., 4437 Roosevelt Rd., Chicago, Ill.
Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia, Pa.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.
New Departure Div., General Motors Corp., Bristol, Conn.
Philadelphia Gear Works, Erie Ave. & G. St., Philadelphia, Pa.
Silent Hoist Winch & Crane Co., 849 63rd St., Brooklyn, N. Y.
Westinghouse Electric & Mfg. Co., 200 McCandless Ave., Pittsburgh, Pa.
Worthington Pump & Machinery Corp., Harrison, N. J.

SPIEGELEISEN
Electro Metallurgical Co., 30 E. 42nd St., New York City.
New Jersey Zinc Co., 160 Front St., New York City.
Samuel, Frank, & Co., Inc., Harrison Bldg., Philadelphia, Pa.

SPIKES (Screw)
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Oliver Iron & Steel Corp., S. 10th & Muriel Sts., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Youngstown Sheet & Tube Co., The, Youngstown, O.

SPINDLE SHAPERS (For Nonferrous Metal, Plastics and Wood)
Walker-Turner Co., Inc., 5013 Berckman St., Plainfield, N. J.

SPINDLES (Grinding)
Bryant Chucking Grinder Co., Springfield, Vt.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, Mich.
Heald Machine Co., Worcester, Mass.

SPINDLES (Lathe)
American Hollow Boring Co., 1054 W. 20th St., Erie, Pa.

SPLICE BARS (Rail)
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.

SPRINGS (*Also Stainless)
*American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
*Barnes, Wallace, Co., The, Div. Associated Spring Corp., 97 Main St., Bristol, Conn.
Hubbard, M. D., Spring Co., 449 Central Ave., Pontiac, Mich.
Lee Spring Co., Inc., 30 Main St., Brooklyn, N. Y.
*Raymond Mfg. Co., Div. Associated Spring Corp., 280 S. Centre St., Corry, Pa.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.
Washburn Wire Co., 118th St. & Harlem River, New York City.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.

SPRINGS (Alloy)
Barnes, Wallace, Co., The, Div. Associated Spring Corp., 97 Main St., Bristol, Conn.
Raymond Mfg. Co., Div. Associated Spring Corp., 280 S. Centre St., Corry, Pa.

SPRINGS (Coil & Elliptic)
Barnes, Wallace Co., The, Div. Associated Spring Corp., 97 Main St., Bristol, Conn.
Raymond Mfg. Co., Div. Associated Spring Corp., 280 S. Centre St., Corry, Pa.
Union Spring & Mfg. Co., New Kensington, Pa.

SPRINGS (Compression)
Barnes, Wallace, Co., The, Div. Associated Spring Corp., 97 Main St., Bristol, Conn.
Raymond Mfg. Co., Div. Associated Spring Corp., 280 S. Centre St., Corry, Pa.

SPRINGS (Flat Coiled)
Washburn Wire Co., 118th & Harlem River, New York City.

SPRINGS (Oil Tempered—Flat)
Barnes, Wallace, Co., The, Div. Associated Spring Corp., 97 Main St., Bristol, Conn.
Davis Brake Beam Co., Laurel Ave., & P. R. R., Johnstown, Pa.
Raymond Mfg. Co., Div. Associated Spring Corp., 280 S. Centre St., Corry, Pa.

SPRINGS (Torsion)
Barnes, Wallace, Co., The, Div. Associated Spring Corp., 97 Main St., Bristol, Conn.
Raymond Mfg. Co., Div. Associated Spring Corp., 280 S. Centre St., Corry, Pa.

SPRINGS (Valve)
Barnes, Wallace, Co., The, Div. Associated Spring Corp., 97 Main St., Bristol, Conn.
Raymond Mfg. Co. Div. Associated Spring Corp., 280 S. Centre St., Corry, Pa.

SPRINKLERS (Automatic)
Grinnell Co., Inc., Providence, R. I.

SPROCKETS
Link-Belt Co., 220 S. Belmont Ave., Indianapolis, Ind.

SPRUE CUTTERS
Consolidated Machine Tool Corp., Winton & Blossom Rds., Rochester, N. Y.
Ferracute Machine Co., Bridgeton, N. J.
Shuster, F. B., Co., The, New Haven, Conn.

STACKS (Steel)—See BRIDGES, ETC.

STAINLESS STEEL—See listings marked "*" under individual product headings.

STACKING MACHINES (Hand and Electric)
Economy Engineering Co., 2657 W. Van Buren St., Chicago, Ill.

STAMPINGS
All-Steel-Equip Co., Inc., 612 Archer Ave., Aurora, Ill.
Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh, Pa.
American Metal Products Co., 5959 Linsdale Ave., Detroit, Mich
American Tube & Stamping Plant, (Stanley Wks.), Bridgeport, Conn.
Barnes, Wallace, Co., The, Div. Associated Spring Corp., 97 Main St., Bristol, Conn.
Davis Brake Beam Co., Laurel Ave., & P. R. R., Johnstown, Pa.
Dayton-Rogers Mfg. Co., Dept. C., 2830 13th Ave. So., Minneapolis, Minn.
Doyle, The, J. E., Co., 1220 West 6th St., Cleveland, O.
Erdle Perforating Co., 171 York St., Rochester, N. Y.
Homestead Valve Mfg. Co., P. O. Box 22, Coraopolis, Pa.
Hubbard, M. D., Spring Co., 449 Central Ave., Pontiac, Mich.
Lansing Stamping Co., Lansing, Mich.
Pressed Steel Tank Co., 1461 S. 66th St., Milwaukee, Wis.
Raymond Mfg. Co., Div. Associated Spring Corp., 280 S. Centre St., Corry, Pa.
Scaife Co., Ann St., Oakmont, Pa.
Schnorr, C. H., & Co., 643 Railroad St., Springdale, Pa.
Spriesch Tool & Mfg. Co., 10 Howard St., Buffalo, N. Y.
Stanley Works, The, Bridgeport, Conn. New Britain, Conn.
Toledo Stamping & Mfg. Co., 90 Fearing Blvd., Toledo, O.
Whitehead Stamping Co., 1667 W. Lafayette Blvd., Detroit, Mich.

STAMPS (Steel)
Cunningham, M. E., Co., 172 E. Carson St., Pittsburgh, Pa.
Matthews, Jas. H., & Co., 3978 Forbes St., Pittsburgh, Pa.

STAPLES (Wire)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Republic Steel Corp., Dept. ST, Cleveland, O.

STAPLES (Wire)—Con.

Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Wickwire Brothers, 189 Main St., Cortland, N. Y.
Youngstown Sheet & Tube Co., The Youngstown, O.

STARTERS (Electric Motor)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.
Electric Controller & Mfg. Co., The, 2698 East 79th St., Cleveland, O.
General Electric Co., Schenectady, N. Y.
Graybar Electric Co., 420 Lexington Ave., New York City
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

STEEL (Alloy)

Alan Wood Steel Co., Conshohocken, Pa.
Allegheny Ludlum Steel Corp., 2319 Oliver Bldg., (22), Pittsburgh, Pa.
American Rolling Mill Co., The, 3271 Curtis St., Middletown, O.
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Anchor Drawn Steel Co., Latrobe, Pa.
Andrews Steel Co., The, Newport, Ky.
Barium Stainless Steel Corp., Canton, O.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Carpenter Steel Co., Reading, Pa.
Colonial Steel Div., Grant Bldg., Pittsburgh, Pa.
Columbia Steel Co., San Francisco, Calif.
Copperweld Steel Co., Warren, O.
Disston, Henry, & Sons, Inc., 1226 Tacony, Philadelphia, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Heppenstall Co., Box S-12, 4620 Hatfield St., Pittsburgh, Pa.
Jessop Steel Co., 584 Green St., Washington, Pa.
Kloster Steel Corp., 224-228 N. Justine St., Chicago, Ill.
Midvale Co., The, Nicetown, Philadelphia, Pa.
Newport Rolling Mill Co., The, Newport, Ky.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Scully Steel Products Co., 1316 Wabansia Ave., Chicago, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Stanley Works, The, New Britain, Conn. Bridgeport, Conn.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.
Vanadium-Alloys Steel Co., Latrobe, Pa.
Washburn Wire Co., Phillipsdale, R. I.
Youngstown Sheet & Tube Co., The, Youngstown, O.

STEEL (Alloy, Cold Finished)

American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bliss & Laughlin, Inc., Harvey, Ill.
Copperweld Steel Co., Warren, O.
Firth-Sterling Steel Co., McKeesport, Pa.
LaSalle Steel Co., Chicago, Ill.
Moltrup Steel Products Co., Beaver Falls, Pa.
Monarch Steel Co., 545 W. McCarty St., Indianapolis, Ind.
Purdy, A. R., Co., Inc., 792 Greenwich St., New York City.
Union Drawn Steel Div. of Republic Steel Corp., Massillon, O.
Wyckoff Drawn Steel Co., First National Bank Bldg., Pittsburgh, Pa.

STEEL (Clad—Corrosion Resisting) (*Also Stainless)

*Allegheny Ludlum Steel Corp., 2319 Oliver Bldg., (22), Pittsburgh, Pa.
*Copperweld Steel Co., Warren, O.
*Granite City Steel Co., Granite City, Ill.
Ingersoll Steel & Disc Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago, Ill.
Jessop Steel Co., 584 Green St., Washington, Pa.
Superior Steel Corp., Carnegie, Pa.

STEEL (Cold Drawn)

American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bliss & Laughlin, Inc., Harvey, Ill.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Moltrup Steel Products Co., Beaver Falls, Pa.
Monarch Steel Co., 545 W. McCarty St., Indianapolis, Ind.
Roebling's John A., Sons Co., Trenton, N. J.
Sutton Engineering Co., Park Bldg., Pittsburgh, Pa.
Timken Roller Bearing Co., The, Canton, O.
Union Drawn Steel Div. of Republic Steel Corp., Massillon, O.
Wyckoff Drawn Steel Co., First National Bank Bldg., Pittsburgh, Pa.

STEEL (Cold Finished)

American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Bliss & Laughlin, Inc., Harvey, Ill.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Chicago, Ill.
Moltrup Steel Products Co., Beaver Falls, Pa.
Monarch Steel Co., 545 W. McCarty St., Indianapolis, Ind.
Purdy, A. R., Co., Inc., 792 Greenwich St., New York City.
Roebling's, John A., Sons Co., Trenton, N. J.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Scully Steel Products Co., 1316 Wabansia Ave., Chicago, Ill.
Union Drawn Steel Div. of Republic Steel Corp., Massillon, O.
Wyckoff Drawn Steel Co., First National Bank Bldg., Pittsburgh, Pa.

STEEL (Corrosion Resisting)

Acme Steel Co., 2826 Archer Ave., Chicago, Ill.
Allegheny Ludlum Steel Corp., 2319, Oliver Bldg., (22), Pittsburgh, Pa.
American Rolling Mill Co., The, 3271 Curtis St., Middletown, O.
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Barium Stainless Steel Corp., Canton, O.
Bethlehem Steel Co., Bethlehem, Pa.
Bissett Steel Co., The, 945 E. 67th St., Cleveland, O.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Carpenter Steel Co., 139 Bern St., Reading, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Granite City Steel Co., Granite City, Ill.
Ingersoll Steel & Disc Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago, Ill.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Jessop, Wm., & Sons, Inc., 627-629 Sixth Ave., New York City.
Jessop Steel Co., 584 Green St., Washington, Pa.
Latrobe Electric Steel Co., Latrobe, Pa.
Midvale Co., The, Nicetown, Philadelphia, Pa.
National Tube Co., Frick Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Roebling's, John A., Sons Co., Trenton, N. J.
Ryerson, Jos. T., & Son., Inc., 16th & Rockwell Sts., Chicago, Ill.
Sharon Steel Corp., Sharon, Pa.
Stanley Works, The, New Britain, Conn. Bridgeport, Conn.
Superior Steel Corp., Carnegie, Pa.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.

STEEL (Die)

Allegheny Ludlum Steel Corp., 2319 Oliver Building (22), Pittsburgh, Pa.
Anchor Drawn Steel Co., Latrobe, Pa.
Carpenter Steel Co., Reading, Pa.
Colonial Steel Div., Grant Bldg., Pittsburgh, Pa
Darwin & Milner, Inc., 1260 W. 4th St., Cleveland, O.
Disston Henry, & Sons, Inc. 1226 Tacony, Philadelphia, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Holliday, W. J., & Co., 545 W. McCarthy St., Indianapolis, Ind.
Jessop, Wm., & Sons, Inc., 627-629 Sixth Ave., New York City.
Jessop Steel Co., 584 Green St., Washington, Pa.
Latrobe Electric Steel Co., Latrobe, Pa.
Midvale Co., The, Nicetown, Philadelphia, Pa.
Vanadium-Alloys Steel Co., Latrobe, Pa.
Timken Roller Bearing Co., The, Canton, O.
Ziv Steel & Wire Co., 2945 W. Harrison St., Chicago, Ill.

STEEL (Electric)

Allegheny Ludlum Steel Corp., 2319 Oliver Building (22), Pittsburgh, Pa.
American Rolling Mill Co., The, 3271 Curtis St., Middletown, O.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Copperweld Steel Co., Warren, O.
Disston, Henry, & Sons, Inc., 926 Tacony, Philadelphia, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Jessop, Wm., & Sons, Inc., 627-629 Sixth Ave., New York City.
Jessop Steel Co., 584 Green St., Washington, Pa.
Latrobe Electric Steel Co., Latrobe, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.

STEEL (High Speed)

Allegheny Ludlum Steel Corp., 2319, Oliver Bldg., (22), Pittsburgh, Pa.
Anchor Drawn Steel Co., Latrobe, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 139 Bern St., Reading, Pa.
Colonial Steel Div., Grant Bldg., Pittsburgh, Pa.
Darwin & Milner, Inc., 1260 W. 4th St., Cleveland, O.
Disston, Henry, & Sons, Inc., 1226 Tacony, Philadelphia, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Ingersoll Steel & Disc Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago, Ill.
Jessop, Wm., & Sons Co., 627-629 Sixth Ave., New York City.
Jessop Steel Co., 584 Green St., Washington, Pa.
Latrobe Electric Steel Co., Latrobe, Pa.
Midvale Co., The, Nicetown, Philadelphia, Pa.
Vanadium-Alloys Steel Co., Latrobe, Pa.
Ziv Steel & Wire Co., 2945 W. Harrison St., Chicago, Ill.

STEEL (High Tensile, Low Alloy)

Alan Wood Steel Co., Conshohocken, Pa.
American Rolling Mill Co., The, 3271 Curtis St., Middletown, O.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Cold Metal Products Co., The, 2131 Wilson Ave., Youngstown, O.
Columbia Steel Co., San Francisco, Calif.
Great Lakes Steel Corp., Ecorse, Detroit, Mich.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Timken Roller Bearing Co., The, Canton, O.
Youngstown Sheet & Tube Co., The, Youngstown, O.

STEEL (Nitrided)

Allegheny Ludlum Steel Corp., 2319, Oliver Bldg., (22), Pittsburgh, Pa.

STEEL (Rustless)—See STEEL (Corrosion Resisting)

STEEL (Screw Stock)

American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Bliss & Laughlin, Inc., Harvey, Ill.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Chicago, Ill.
Moltrup Steel Products Co., Beaver Falls, Pa.
Monarch Steel Co., 545 W. McCarty St., Indianapolis, Ind.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Union Drawn Steel Div. of Republic Steel Corp., Massillon, O.
Wyckoff Drawn Steel Co., First National Bank Bldg., Pittsburgh, Pa.
Youngstown Sheet & Tube Co., The, Youngstown, O.

STEEL (Solder Coated)

Thomas Steel Co., The, Warren, O.

STEEL (Spring)

American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Barnes, Wallace Co., The, Div. Associated Spring Corp., 97 Main St., Bristol, Conn.
Cold Metal Products Co., The, 2131 Wilson Ave., Youngstown, O.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Purdy, A. R., Co., Inc., 792 Greenwich St., New York City.
Roebling's, John A., Sons Co., Trenton, N. J.
Thomas Steel Co., The, Warren, O.
Washburn Wire Co., 118th St. & Harlem River, New York City, Phillipsdale, R. I.
Youngstown Sheet & Tube Co., The, Youngstown, O.

STEEL (Stainless)—See listings marked "*" under individual product headings.

STEEL (Strapping)

Atkins, E. C., & Co., 427 S. Illinois St., Indianapolis, Ind.

STEEL (Strip—Brass, Bronze Copper and Nickel Coated)

American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Stanley Works, The, New Britain, Conn. Bridgeport, Conn.
Thomas Steel Co., The, Warren, O.

STEEL (Strip—Hot or Cold Rolled) (*Also Stainless)

*Acme Steel Co., 2826 Archer Ave., Chicago, Ill.
*Allegheny Ludlum Steel Corp., 2319, Oliver Bldg., (22), Pittsburgh, Pa.
*American Rolling Mill Co., The, 3271 Curtis St., Middletown, O.
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
American Tube & Stamping Plant, (Stanley Wks.), Bridgeport, Conn.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
*Carpenter Steel Co., Reading, Pa.
Cold Metal Products Co., The, 2131 Wilson Ave., Youngstown, O.
Columbia Steel Co., San Francisco, Calif.
Enterprise Galvanizing Co., 2525 E. Cumberland St., Philadelphia, Pa.
Great Lakes Steel Corp., Ecorse, Detroit, Mich.
Ingersoll Steel & Disc Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago, Ill.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Jessop, Wm., & Sons, Inc., 627-629 Sth Ave., New York City.
Jessop Steel Co. 584 Green St., Washington, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
McLouth Steel Corp., 300 S. Livernois Ave., Detroit, Mich.
Republic Steel Corp., Dept. ST, Cleveland, O.
Roebling's, John A., Sons Co., Trenton, N. J.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
*Scully Steel Products Co., 1316 Wabansia Ave., Chicago, Ill.
Seneca Wire & Mfg. Co., Fostoria, O.
Sharon Steel Corp., Sharon, Pa.
*Stanley Works, The, New Britain, Conn. Bridgeport, Conn.
Superior Steel Corp., Carnegie, Pa.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Thomas Steel Co., The, Warren, O.
Washburn Wire Co., 118th St. & Harlem River, New York City, Phillipsdale, R. I.
Weirton Steel Co., Weirton, W. Va.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.
Youngstown Sheet & Tube Co., The, Youngstown, O.

STEEL (Strip—Tin Coated)

American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Roebling's, John A., Sons Co., Trenton, N. J.
Thomas Steel Co., The, Warren, O.
Washburn Wire Co., 118th St. & Harlem River, New York City.

STEEL (Strip—Zinc Coated)

Acme Steel Co., 2826 Archer Ave., Chicago, Ill.
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Roebling's, John A., Sons Co., Trenton, N. J.
Thomas Steel Co., The, Warren, O.
Washburn Wire Co., 118th St. & Harlem River, New York City.

STEEL (Structural) (*Also Stainless)

American Bridge Co., Frick Bldg., Pittsburgh, Pa.
Belmont Iron Works, 22nd St. and Washington Ave., Philadelphia, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
*Carnegie-Illinois Steel Corp. Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Enterprise Galvanizing Co., 2525 E. Cumberland St., Philadelphia, Pa.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
Levinson Steel Sales Co., The, 33 Pride St., Pittsburgh, Pa.
*Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
*Scully Steel Products Co., 1316 Wabansia Ave., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Weirton Steel Co., Weirton, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

STEEL (Tool)

Allegheny Ludlum Steel Corp., Dept. 2319, Oliver Bldg., (22), Pittsburgh, Pa.
Anchor Drawn Steel Co., Latrobe, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Bissett Steel Co., The, 947 E. 67th St., Cleveland, O.
Carpenter Steel Co., 139 Bern St., Reading, Pa.
Colonial Steel Div., Grant Bldg., Pittsburgh, Pa.
Copperweld Steel Co., Warren, O.
Darwin & Milner, Inc., 1260 W. 4th St., Cleveland, O.
Disston, Henry, & Sons, Inc., 1226 Tacony, Philadelphia, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Ingersoll Steel & Disc Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago, Ill.
Jessop, Wm., & Sons Co., 627-629 Sixth Ave., New York City.
Jessop Steel Co., 584 Green St., Washington, Pa.
Kloster Steel Corp., 224-228 N. Justine St., Chicago, Ill.
Latrobe Electric Steel Co., Latrobe, Pa.
Midvale Co., The, Nicetown, Philadelphia, Pa.
National Broach & Mach. Co., 5800 St. Jean, Detroit, Mich.
Purdy, A. R., Co., Inc., 792 Greenwich St., New York City.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Tennessee Coal, Iron and Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Timken Roller Bearing Co., The, Canton, O.
Vanadium-Alloys Steel Co., Latrobe, Pa.
Ziv Steel & Wire Co., 2943 W. Harrison St., Chicago, Ill.

STEEL BUILDINGS—See BRIDGES, BUILDINGS, ETC.

STEEL DOORS & SHUTTERS—See DOORS & SHUTTERS

STEEL FABRICATORS—See BRIDGES, BUILDINGS, ETC.

STEEL FLOATING AND TERMINAL EQUIPMENT

Dravo Corp. (Engineering Works Div.), Neville Island, Pittsburgh, Pa.

STEEL, NICKEL (Cold Drawn)

Bethlehem Steel Co., Bethlehem, Pa.
Bliss & Laughlin, Inc., Harvey, Ill.
Republic Steel Co., Dept. ST. Cleveland, O.
Union Drawn Steel Div., Republic Steel Corp., Massillon, O.

STEEL PLATE CONSTRUCTION

American Bridge Co., Frick Bldg., Pittsburgh, Pa.
Bartlett-Hayward Div., Koppers Co., Baltimore, Md.
Belmont Iron Works, 22nd St., and Washington Ave., Philadelphia, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Federal Shipbuilding & Dry Dock Co., Kearney, N. J.
General American Transportation Corp., 135 S. LaSalle, St., Chicago, Ill.
Graver Tank & Mfg. Co., Inc., 4809-40 Tod Ave., E. Chicago, Ind.
Hendrick Mfg. Co., Carbondale, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.
Struthers Wells Corp., Titusville, Pa.

STELLITE

Haynes Stellite Co., Harrison and Lindsay Sts., Kokomo, Ind.

STENCILS (Spray and Sand Blast)

Matthews, Jas. H., & Co., 3978 Forbes St., Pittsburgh, Pa.

STEPS (Safety)

Hendrick Mfg. Co., Carbondale, Pa.

STICKERS (Identification, Instruction, Rejection)

Avery Adhesives, 451 E. 3rd St., Los Angeles, Calif.

STOKERS

Babcock & Wilcox Co., The, 85 Liberty St., New York City
Westinghouse Electric & Mfg. Co., Steam Div., Lester, Pa.

STONES (Honing, Polishing, Sharpening)

Bay State Abrasive Products Co., Westboro, Mass.
Carborundum Co., The, Niagara Falls, N. Y.
Norton Company, Worcester, Mass.

STOPPERS (Cinder Notch)

Bailey, Wm. M., Co., 702 Magee Bldg., Pittsburgh, Pa.
Brosius, Edgar E., Co., Sharpsburg Branch, Pittsburgh, Pa.

STOPPERS (Rubber)

Rhoades, R. W., Metaline Co., 50-17 Fifth St., Long Island City, N. Y.

STORAGE EQUIPMENT

Graver Tank & Mfg. Co., Inc., 4809-40 Tod Ave., E. Chicago, Ind.

STORAGE BATTERIES—See BATTERIES (Storage)

STRAIGHTENING MACHINERY

Aetna-Standard Engineering Co., The, Home Savings Bank Bldg., Youngstown, O.
American Foundry Equipment Co., The, Mishawaka, Ind.
Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia, Pa.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.
Consolidated Machine Tool Corp., Winton & Blossom Rds., Rochester, N. Y.
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.
Farquhar, A. B., Co., Ltd., 195 Duke St., York, Pa.
Hanniffin Mfg. Co., 621 S. Kolmar Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Hydropress, Inc., 570 Lexington Ave., New York City.
Kane & Roach, Inc., Niagara & Shonnard Sts., Syracuse, N. Y.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Lewis Machine Co., 3450 E. 76th St., Cleveland, O
Logemann Brothers Co., 3126 Burleigh St., Milwaukee, Wis.
Shuster, F. B., Co., The, New Haven, Conn.
Sutton Engineering Co., Park Bldg., Pittsburgh, Pa.
Taylor-Wilson Mfg. Co., 13 Thomson Ave., McKees Rocks, Pa.

SULPHURIC ACID

Cleveland-Cliffs Iron Co., The, Union Commerce Bldg., Cleveland, O.
New Jersey Zinc Co., 160 Front St., New York City.
Pennsylvania Salt Mfg. Co., Widener Bldg., Philadelphia, Pa.

SWAGING MACHINES

Etna Machine Co., The, 3400 Maplewood Ave., Toledo, O.
Ferracute Machine Co., Bridgeton, N. J.
Standard Machinery Co., Providence, R. I.
Torrington Co., The, Torrington, Conn.

SWITCHES (Electric)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.
Electric Controller & Mfg. Co., The, 2700 E. 79th St., Cleveland, O.
General Electric Co., Sec. H, 750-159, Schenectady, N. Y.
Graybar Electric Co., 420 Lexington Ave., New York City
Mallory, P. R., & Co., 3029 E. Washington Ave., Indianapolis, Ind.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.

TABLES (Elevating)

Lyon-Raymond Corp., 131 Madison St., Greene, N. H.

TACHOMETERS

Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Brown Instrument Div. of Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia, Pa.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Hays Corp., The, Michigan City, Ind.
Westinghouse Electric & Mfg. Co., Orange Ave., Newark, N. J.

TANK LININGS

Ceilcote Co., 730 Rockefeller Bldg., Cleveland, O.
National Carbon Co., W. 117th St. and Madison Ave., Cleveland, O.
National Lead Co., 111 Broadway, New York City
Pennsylvania Salt Mfg. Co., Widener Bldg., Philadelphia, Pa.

TANKS (Gas Auxiliary)

Webb Corp., The, Webb City, Mo.

TANKS (Pickling)

National Carbon Co., W. 117th St. and Madison Ave., Cleveland, O.
United States Rubber Co., 1230 Sixth Ave., New York City.

TANKS (Storage, Pressure, Riveted, Welded)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh, Pa.
American Bridge Co., Frick Bldg., Pittsburgh, Pa.
Bartlett-Hayward Div., Koppers Co., Baltimore, Md.
Bethlehem Steel Co., Bethlehem, Pa.
General American Transportation Corp., 135 S. LaSalle St., Chicago, Ill.
Graver Tank & Mfg. Co., Inc., 4809-40 Tod Ave., E. Chicago, Ind.
Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.
Pressed Steel Tank Co., 1461 S. 66th St., Milwaukee, Wis.
Scaife Co., Ann St., Oakmont, Pa.
Struthers Wells Corp., Titusville, Pa.

TANKS (Wood or Steel, Rubber or Lead Lined)

American Hard Rubber Co., 11 Mercer St., New York City.
National Lead Co., 111 Broadway, New York City

TANTALUM CARBIDE

Carboloy Co., Inc., 11141 E. Eight Mile Rd., Detroit, Mich.

TAPES (Adhesive-Paper, Cloth, Fibre, Acetate, Film Backing)
General Electric Co., Bridgeport, Conn.
Minnesota Mining & Mfg. Co., 900 Fauquier St., St. Paul, Minn.

TAPS AND DIES
Consolidated Machine Tool Corp., Winton & Blossom Rds., Rochester, N. Y.
Detroit Tap & Tool Co., 8432 Butler St., Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., The, 170 E. 131st St., Cleveland, O.
Oster Mfg. Co., The, 2037 E. 61st St., Cleveland, O.
Woodworth, N. A., Co., 1241 Wanda Ave., Ferndale, Mich.

TERMINALS (Locking)
Thompson-Bremer & Co., 1644 W. Hubbard St., Chicago, Ill.

TERNE PLATE—See TIN OR TERNE PLATE

TESTING MACHINERY (Materials)
Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia, Pa.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
National Broach & Machine Co., 5600 St. Jean, Detroit, Mich.

THERMIT WELDING EQUIPMENT AND MATERIALS
Metal & Thermit Corp., 120 Broadway, New York City.

THERMOMETERS
Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Brown Instrument Div. of Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia, Pa.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia, Pa.

THREAD CUTTING TOOLS
Detroit Tap & Tool Co., 8432 Butler St., Detroit, Mich.
Landis Machine Co., Waynesboro, Pa.
Oster Mfg. Co., The, 2037 E. 61st St., Cleveland, O.

TIE PLATES
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Republic Steel Corp., Dept. ST, Cleveland, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Weirton Steel Co., Weirton, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

TIN OR TERNE PLATE
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Granite City Steel Co., Granite City, Ill.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Tennessee Coal Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Weirton Steel Co., Weirton, W. Va.
Wheeling Steel Corp., Wheeling, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

TIN PLATE MACHINERY
Aetna-Standard Engineering Co., The, Home Savings Bank Bldg., Youngstown, O.
Kemp, C. M., Mfg. Co., 405 E. Oliver St., Baltimore, Md.
Wean Engineering Co., Warren, O.

TITANIUM
Titanium Alloy Mfg. Co., The, Niagara Falls, N. Y.
Vanadium Corp. of America, 420 Lexington Ave., New York City.

TONGS (Automatic)
Heppenstall Co., S-12, 4620 Hatfield St., Pittsburgh, Pa.

TONGS (Chain Pipe)
Williams, J. H., & Co., 400 Vulcan St., Buffalo, N. Y.

TONGS (Rail Handling)
Cullen-Friestedt Co., 1308 S. Kilbourn Ave., Chicago, Ill.

TOOL BITS
Colonial Steel Div., Grant Bldg., Pittsburgh, Pa.
Vanadium-Alloys Steel Co., Latrobe, Pa.

TOOL BITS (High Speed)
Allegheny Ludlum Steel Corp., 2319, Oliver Bldg., (22) Pittsburgh, Pa.
Carpenter Steel Co., Reading, Pa.
Disston, Henry, & Sons, Inc., 1226 Tacony, Philadelphia, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Haynes Stellite Co., Harrison and Lindsay Sts., Kokomo, Ind.
Jessop Steel Co., 584 Green St., Washington, Pa.
Latrobe Electric Steel Co., Latrobe, Pa.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.
Midvale Co., The, Nicetown, Philadelphia, Pa.
Tuff-Hard Corp., 5960 Caniff Ave., Detroit, Mich.
Ziv Steel & Wire Co., 2945 W. Harrison St., Chicago, Ill.

TOOL HOLDERS
Apex Machine & Tool Co., 1025 S. Patterson Blvd., Dayton, O.
Gisholt Machine Co., 1217 E. Washington Ave., Madison, Wis.
South Bend Lathe Works, South Bend, Ind.
Williams, J. H., & Co., 400 Vulcan St., Buffalo, N. Y.

TOOLS (Diamond)
Diamond Tool Co., 938 E. 41st St., Chicago, Ill.

TOOLS (Non-Sparking, Safety)
Ampco Metal, Inc., Dept. S-1, Milwaukee, Wis.

TOOLS (Pneumatic)
Cleveland Pneumatic Tool Co., The, 3734 E 78th St., Cleveland, O.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.

TOOLS (Precision, Lathe, Metal Cutting, etc.)
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Co., Inc., 11141 E. Eight Mile Rd., Detroit, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Genesee Tool Co., Fenton, Mich.
Gisholt Machine Co., 1217 E. Washington Ave., Madison, Wis.
McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.
Micromatic Hone Corp., 1800 Schoolcraft Ave., Detroit, Mich.

TOOLS (Steel-Cutting)
Carboloy Co., Inc., 11141 E. 8 Mile Rd., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Genesee Tool Co., Fenton, Mich.
Illinois Tool Works, 2501 N. Keeler Ave., Chicago, Ill.
McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.
Tuff-Hard Corp., 5960 Caniff Ave., Detroit, Mich.

TOOLS (Tantalum Carbide)
Carboloy Co., Inc., 11141 E. 8 Mile Rd., Detroit, Mich.

TOOLS (Tipped, Carbide)
Carboloy Co., Inc., 11141 E. 8 Mile Rd., Detroit, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Genesee Tool Co., Fenton, Mich.
McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.

TOOLS (Turning, Boring and Facing)
Carboloy Co., Inc., 11141 E. 8 Mile Rd., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Genesee Tool Co., Fenton, Mich.
Gisholt Machine Co., 1217 E. Washington Ave., Madison, Wis.
Luers, J. Milton, Mount Clemens, Mich.
McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.
South Bend Lathe Works, South Bend, Ind.
Tuff-Hard Corp., 5960 Caniff Ave., Detroit, Mich.

TORCHES & BURNERS (Acetylene, Blow, Oxy-Acetylene)
Air Reduction, 60 E. 42nd St., New York City.
Linde Air Products Co., The, 30 E. 42nd St., New York City.
National Cylinder Gas Co., 205 W. Wacker Drive, Chicago, Ill.

TOWBOATS
Dravo Corp. (Engin'r'g Works Div.) Neville Island, Pittsburgh, Pa.

TOWERS (Cooling)
Pritchard, J. F., & Co., Dwight Bldg., Kansas City, Mo.

TOWERS (Transmission)
American Bridge Co., Frick Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.

TOWERS (Tubular Hoisting)
Dravo Corp., (Machinery Div.) 300 Penn Ave., Pittsburgh, Pa.

TRACK ACCESSORIES
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Foster, L. B., Co., Inc., P. O. Box 1647, Pittsburgh, Pa.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Oliver Iron & Steel Corp., S. 10th & Muriel Sts., Pittsburgh, Pa.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.

TRACK BOLTS—See BOLTS (Track)

TRAILERS
Easton Car & Construction Co., Easton, Pa.
Mercury Manufacturing Co., 4140 S. Halsted St., Chicago, Ill.
Ohio Galvanizing & Mfg. Co., Penn St., Niles, O.

TRAMRAILS
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., 1125 E. 283rd St., Wickliffe, O.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.

TRANSFORMERS (Electric)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Graybar Electric Co., 420 Lexington Ave., New York City
Westinghouse Electric & Mfg. Co., Sharon, Pa.

TRANSMISSIONS—VARIABLE SPEED
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia, Pa.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

TREADS (Safety)
Alan Wood Steel Co., Conshohocken, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Dravo Corp. (Machinery Div.), 300 Penn Ave., Pittsburgh, Pa.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Norton Company, Worcester, Mass.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Tri-Lok Co., 5515 Butler St., Pittsburgh, Pa.

TROLLEYS
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Ford Chain Block Div., American Chain & Cable Co. Inc., 2nd & Diamond Sts., Philadelphia, Pa.
Reading Chain & Block Corp., Dept. D-10, Reading, Pa.
Wright Mfg. Div. of American Chain & Cable Co., Inc., York, Pa.

TRUCK CRANES
Northwest Engineering Co., 28 E. Jackson Blvd., Chicago, Ill.
Silent Hoist Winch & Crane Co., 849 63rd St., Brooklyn, N. Y.

TRUCKS AND TRACTORS (Electric Industrial)
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
Baker-Raulang Co., The, 2167 W. 25th St., Cleveland, O.
Easton Car & Construction Co., Easton, Pa.
Elwell-Parker Electric Co., The, 4205 St. Clair Ave., Cleveland, O.
Mercury Manufacturing Co., 4140 S. Halsted St., Chicago, Ill.

TRUCKS AND TRACTORS (Gasoline or Diesel—Industrial)
Baker-Raulang Co., The, 2167 W. 25th St., Cleveland, O.
Buda Co., The, Harvey, Ill.
Clark Trucktractor Div., Clark Equipment Co., 127 Springfield Place, Battle Creek, Mich.
Elwell-Parker Electric Co., The, 4205 St. Clair Ave., Cleveland, O.
Mercury Manufacturing Co., 4140 S. Halsted St., Chicago, Ill.
Silent Hoist Winch & Crane Co., 849 63rd St., Brooklyn, N. Y.
Towmotor Co., 1223 E. 152nd St., Cleveland, O.

TRUCKS (Dump-Industrial)
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
Easton Car & Construction Co., Easton, Pa.
Towmotor Co., 1223 E. 152nd St., Cleveland, O.

TRUCKS (Hydraulic Lift)

Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
Baker-Raulang Co., The, 2167 W. 25th St., Cleveland, O.
Elwell-Parker Electric Co., The, 4205 St. Clair Ave., Cleveland, O.
Clark Trucktractor Div., Clark Equipment Co., 127 Springfield Place, Battle Creek, Mich.
Lyon Raymond Corp., 131 Madison St., Greene, N. Y.
Mercury Mfg. Co., 4044 S. Halsted St., Chicago, Ill.
Towmotor Co., 1223 E. 152nd St., Cleveland, O.

TRUCKS (Industrial)

Baker-Raulang Co., The, 2167 W. 25th St., Cleveland, O.
Buda Co., The, Harvey, Ill.
Easton Car & Construction Co., Easton, Pa.
Mercury Manufacturing Co., 4140 S. Halsted St., Chicago, Ill.
Ohio Galvanizing & Mfg. Co., Penn St., Niles O.
Towmotor Co., 1223 E. 152nd St., Cleveland, O.

TRUCKS (Lift)

Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
Baker-Raulang Co., The, 2167 W. 25th St., Cleveland, O.
Clark Trucktractor Div., Clark Equipment Co., 127 Springfield Pl., Battle Creek, Mich.
Easton Car & Construction Co., Easton, Pa.
Elwell-Parker Electric Co., The, 4501 St. Clair Ave., Cleveland, O.
Lyon-Raymond Corp., 131 Madison St., Greene, N. Y.
Mercury Manufacturing Co., 4140 S. Halsted St., Chicago, Ill.
Towmotor Co., 1223 E. 152nd St., Cleveland, O.

TUBE FITTINGS

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh, Pa.
Weatherhead Co., The, 300 East 131st St., Cleveland, O.

TUBE MILL EQUIPMENT

Aetna-Standard Engineering Co., The, Home Savings Bank Bldg., Youngstown, O.
Mackintosh-Hemphill Co., 9th and Bingham Sts., Pittsburgh, Pa.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Taylor-Wilson Mfg. Co., 1200 Thomson Ave., McKees Rocks, Pa.
Yoder Co., The, W. 55th & Walworth Ave., Cleveland, O.

TUBE WELDING MACHINES

Etna Machine Co., The, 3400 Maplewood Ave., Toledo, O.

TUBES (Boiler)

Allegheny Ludlum Steel Corp., 2319 Oliver Bldg., (22), Pittsburgh, Pa.
Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Bissett Steel Co., The, 947 E. 67th St., Cleveland, O.
Columbia Steel Co., San Francisco, Calif.
Electroweld Steel Co., Oil City, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
National Tube Co., Frick Bldg., Pittsburgh, Pa.
Ohio Seamless Tube Co., Shelby, O.
Ryerson Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Steel and Tubes Division, Republic Steel Corp., 226 E. 131st St., Cleveland, O.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.
Tubular Service Corp., 120 44th St., Brooklyn, N. Y.
Youngstown Sheet & Tube Co., The, Youngstown, O.

TUBES (Brass, Bronze, Copper, Nickel, Nickel Silver)

American Brass Co., The, Waterbury, Conn.
Bridgeport Brass Co., Bridgeport, Conn.
International Nickel Co., Inc., The, 67 Wall St., New York City
Lewin-Mathes Co., St. Louis, Mo.
Revere Copper & Brass, Inc., 230 Park Ave., New York City.
Shenango-Penn Mold Co., 407 W. Third St., Dover, O.

TUBES (Combustion)

Carborundum Co., The, Niagara Falls, N. Y.

TUBES (High Carbon)

Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
National Tube Co., Frick Bldg., Pittsburgh, Pa.
Ohio Seamless Tube Co., Shelby, O.
Steel and Tubes Division, Republic Steel Corp., 226 E. 131st St., Cleveland, O.
Tubular Service Corp., 120 44th St., Brooklyn, N. Y.

TUBING (Alloy Steel) (*Also Stainless)

*Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
Bissett Steel Co., The, 947 E. 67th St., Cleveland, O.
Columbia Steel Co., San Francisco, Calif.
*Flori Pipe Co., The, Red Bud & Bulwer Aves., St. Louis, Mo.
*National Tube Co., Frick Bldg., Pittsburgh, Pa.
Ohio Seamless Tube Co., Shelby, O.
Steel and Tubes Division, Republic Steel Corp., 226 E. 131st St., Cleveland, O.
Tubular Service Corp., 120 44th St., Brooklyn, N. Y.

TUBING (Aluminum, Brass, Copper, Silicon Bronze)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh, Pa.
American Brass Co., The, Waterbury, Conn.
Bridgeport Brass Co., Bridgeport, Conn.
Calumet and Hecla Consolidated Copper Co., Wolverine Tube Div., 1435 Central Ave., Detroit, Mich.
Lewin-Mathes Co., St. Louis, Mo.
Revere Copper & Brass, Inc., 230 Park Ave., New York City.
Shenango-Penn Mold Co., 407 W. Third St., Dover, O.

TUBING (Flexible Metal)

Chicago Metal Hose Corp., 1315 S. Third St., Maywood, Ill.
Pennsylvania Flexible Metallic Tubing Co., 7219 Powers Lane, Philadelphia, Pa.

TUBING (Magnesium)

Dow Chemical Co., The, Midland, Mich.

TUBING (Monel)

Bundy Tubing Co., 10951 Hern Ave., Detroit, Mich
International Nickel Co., Inc., The, 67 Wall St., New York City

TUBING (Seamless, Aluminum)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh, Pa.

TUBING (Seamless Flexible Metal)

American Metal Hose Branch of The American Brass Co., Waterbury, Conn.

TUBING (Seamless Steel)

Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
Columbia Steel Co., San Francisco, Calif.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
National Tube Co., Frick Bldg., Pittsburgh, Pa.
Ohio Seamless Tube Co., Shelby, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.
Tubular Service Corp., 120 44th St., Brooklyn, N. Y.
Youngstown Sheet & Tube Co., The, Youngstown, O.

TUBING (Square, Rectangular and Shapes) (*Also Stainless)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh, Pa.
*Carpenter Steel Co., Reading, Pa.
*National Tube Co., Frick Bldg., Pittsburgh, Pa.
Ohio Seamless Tube Co., Shelby, O.
Steel & Tubes Division, Republic Steel Corp., 226 E. 131st St., Cleveland, O.
Tubular Service Corp., 120 44th St., Brooklyn, N. Y.

TUBING (Welded Steel) (*Also Stainless)

American Metal Products Co., 5959 Linsdale Ave., Detroit, Mich.
Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
Bundy Tubing Co., 10951 Hern Ave., Detroit, Mich.
*Carpenter Steel Co., Reading, Pa.
Electroweld Steel Co., Oil City, Pa.
Flori Pipe Co., The, Red Bud & Bulwer Aves., St. Louis, Mo.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
National Tube Co., Frick Bldg., (P. O. Box 132), Pittsburgh, Pa.
Ohio Seamless Tube Co., Shelby, O.
Republic Steel Corp., Dept. ST, Cleveland, O.
Revere Copper & Brass, Inc., 230 Park Ave., New York City.
Standard Tube Co., The, 14600 Woodward Ave., Detroit, Mich.
Steel and Tubes Division, Republic Steel Corp., 226 E. 131st St., Cleveland, O.
Tubular Service Corp., 120 44th St., Brooklyn, N. Y.
Youngstown Sheet & Tube Co., The, Youngstown, O.

TUBULAR PRODUCTS

American Metal Products Co., 5959 Linsdale Ave., Detroit, Mich.
Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
Bundy Tubing Co., 10951 Hern Ave., Detroit, Mich.
National Tube Co., Frick Bldg., (P. O. Box 132), Pittsburgh, Pa.
Ohio Seamless Tube Co., Shelby, O.
Standard Tube Co., The, 14600 Woodward Ave., Detroit, Mich.
Steel and Tubes Division, Republic Steel Corp., 226 E. 131st St., Cleveland, O.
Tubular Service Corp., 120 44th St., Brooklyn, N. Y.
Youngstown Sheet & Tube Co., The, Youngstown, O.

TUMBLING BARRELS (Coke Testing)

Brosius, Edgar E., Co., Sharpsburg Branch, Pittsburgh, Pa.

TUNGSTEN CARBIDE

Bissett Steel Co., The, 947 E. 67th St., Cleveland, O.
Haynes Stellite Co., Harrison and Lindsay Sts., Kokomo, Ind.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.

TUNGSTEN CARBIDE (Tools and Dies)

Carboloy Co., Inc., 11141 E. 8 Mile Rd., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Genesee Tool Co., Fenton, Mich.
McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.

TUNGSTEN METAL AND ALLOYS

Electro Metallurgical Co., 30 E. 42nd St., New York City.

TURBINES (Steam)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Co., Sec. H, 750-139, Schenectady, N. Y.
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.

TURBO BLOWERS—See BLOWERS

TURNTABLES

American Bridge Co., Frick Bldg., Pittsburgh, Pa.
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
Easton Car & Construction Co., Easton, Pa.

TURRET LATHES—See LATHES (Turret)

TURRET LATHE CUTTERS (Carbide Tipped)

Firth-Sterling Steel Co., McKeesport, Pa.
McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.

TWIST DRILLS

Cleveland Twist Drill Co., The, 1242 E. 49th St., Cleveland, O.
Greenfield Tap & Die Corp., Greenfield, Mass.

UNIT HEATERS

American Foundry Equipment Co., The, Mishawaka, Ind.
Dravo Corp., (Machinery Div.) 300 Penn Ave., Pittsburgh, Pa.
Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.
Graybar Electric Co., 420 Lexington Ave., New York City
Grinnell Co., Inc., Providence, R. I.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.

VACUUM CLEANERS

General Electric Co., Bridgeport, Conn.
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.

VALVE CONTROL (Motor Operated Units)

Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.
Ward Leonard Electric Co., Mt. Vernon, N. Y.

VALVE CONTROLS

Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Hays Corp., The, Michigan City, Ind.
Philadelphia Gear Works, Erie Ave. & G St., Philadelphia, Pa.

VALVES (Blast Furnace)

Bailey, Wm. M., Co., 702 Magee Bldg., Pittsburgh, Pa.
Brosius, Edgar E., Co., Sharpsburg, Branch, Pittsburgh, Pa.
Freyn Engineering Co., 310 S. Michigan Ave., Chicago, Ill.
R-S Products Corp., 4530 Germantown Ave., Philadelphia, Pa.

VALVES (Blow-off)

Crane Co., 836 S. Michigan Ave., Chicago, Ill.
Homestead Valve Mfg. Co., P. O. Box 22, Coraopolis, Pa.

VALVES (Brass, Iron or Steel)

Crane Co., 836 S. Michigan Ave., Chicago, Ill.
Flori Pipe Co., The, Red Bud & Bulwer Aves., St. Louis.
Galland-Henning Mfg. Co., 2753 S. 31st St., Milwaukee, Wis.
R-S Products Corp., 132 Berkley St., Philadelphia, Pa.
Reading-Pratt & Cady Div. of American Chain & Cable Co., Inc., Reading, Pa.
Weatherhead Co., The, 300 E. 131st St., Cleveland, O.

VALVES (Butterfly)

Crane Co., 836 S. Michigan Ave., Chicago, Ill.
R-S Products Corp., 132 Berkley St., Philadelphia, Pa.

VALVES (Check)

Crane Co., 836 S. Michigan Ave., Chicago, Ill.

VALVES (Check)—Con.

Reading-Pratt & Cady Div. of American Chain & Cable Co., Inc., Reading, Pa.
Watson-Stillman Co., Roselle, N. J.
Weatherhead Co., The, 300 E. 131st St., Cleveland, O.

VALVES (Control—Air or Hydraulic)

Auker-Holth Mfg. Co.—Airgrip Chuck Div., 332 S. Michigan Ave., Chicago, Ill.
Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia, Pa.
Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Crane Co., 836 S. Michigan Ave., Chicago, Ill.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Galland-Henning Mfg. Co., 2747 S. 31st St., Milwaukee, Wis.
Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill.
Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago, Ill.
Homestead Valve Mfg. Co., P. O. Box 22, Coraopolis, Pa.
Hunt, C. B. & Son, Salem, Ohio
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Racine Tool & Machine Co., Racine, Wis.
R-S Products Corp., 132 Berkley St., Philadelphia, Pa.
Weatherhead Co., The, 300 E. 131st St., Cleveland, O.

VALVES (Electrically Operated)

Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Crane Co., 836 S. Michigan Ave., Chicago, Ill.
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Galland-Henning Mfg. Co., 2753 South 31st St., Milwaukee, Wis.
Hunt, C. B. & Son, Salem, Ohio
R-S Products Corp., 132 Berkley St., Philadelphia, Pa.

VALVES (Gas and Air Reversing)

Blaw-Knox Co., Blawnox, Pa.
Crane Co., 836 S. Michigan Ave., Chicago, Ill.

VALVES (Gate)

Bartlett-Hayward Div., Koppers Co., Baltimore, Md.
Crane Co., The, 836 S. Michigan Ave., Chicago, Ill.
Reading-Pratt & Cady Div. of American Chain & Cable Co., Inc., Reading, Pa.

VALVES (Globe)

Crane Co., 836 S. Michigan Ave., Chicago, Ill.
Reading-Pratt & Cady Div. of American Chain & Cable Co., Inc., Reading, Pa.
Watson-Stillman Co., Roselle, N. J.

VALVES (Hydraulic)

Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia, Pa.
Bayard, M. L., & Co., 20th & Indiana Ave., Philadelphia, Pa.
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Crane Co., 836 S. Michigan Ave., Chicago, Ill.
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.
Galland-Henning Mfg. Co., 2753 South 31st St., Milwaukee, Wis.
Homestead Valve Mfg. Co., P. O. Box 22, Coraopolis, Pa.
Hunt, C. B. & Son, Salem, Ohio
Hydraulic Press Mfg. Co., Mt. Gilead, O.
R-S Products Corp., 132 Berkley St., Philadelphia, Pa.
Racine Tool & Machine Co., Racine, Wis.
Watson-Stillman Co., Roselle, N. J.
Wood, R. D., Co., 400 Chestnut St., Philadelphia, Pa.

VALVES (Hydraulic-Descaling)

Hunt, C. B., & Son, Salem, O.

VALVES (Needle)

Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia, Pa.
Crane Co., 836 S. Michigan Ave., Chicago, Ill.
Reading-Pratt & Cady Div. of American Chain & Cable Co., Inc., Reading, Pa.
Watson-Stillman Co., Roselle, N. J.

VALVES (Plug)

Crane Co., 836 S. Michigan Ave., Chicago, Ill.
Homestead Valve Mfg. Co., P. O. Box 22, Coraopolis, Pa.

VALVES (Proportioning)

North American Mfg. Co., The, 2910 E. 75th St., Cleveland, O.

VALVES (Steam and Water)

Crane Co., 836 S. Michigan Ave., Chicago, Ill.
R-S Products Corp., 132 Berkley St., Philadelphia, Pa.
Reading-Pratt & Cady Div. of American Chain & Cable Co., Inc., Reading, Pa.

VALVES AND FITTINGS—See PIPE FITTINGS

VANADIUM

Electro Metallurgical Co., 30 E. 42nd St., New York City.
Vanadium Corp. of America, 420 Lexington Ave., New York City.

VIADUCTS (Steel)—See BRIDGES, ETC.

VISES (Pneumatic)

Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago, Ill.

WALKWAYS—See FLOORING—(Steel)

WASHERS (Iron and Steel)

Garrett, George K., Co., D & Tioga Sts., Philadelphia, Pa.
Hubbard, M. D., Spring Co., 449 Central Ave., Pontiac, Mich.
Thompson-Bremer & Co., 1644 W. Hubbard St., Chicago, Ill.
Whitehead Stamping Co., 1661 W. LaFayette Blvd., Detroit, Mich.

WASHERS (Lead)

National Lead Co., 111 Broadway, New York City

WASHERS (Lock)

Garrett, George K., Co., D & Tioga Sts., Philadelphia, Pa.
National Lock Washer Co., Newark, N. J.
Thompson-Bremer & Co., 1644 W. Hubbard St., Chicago, Ill.

WASHERS (Nonferrous and Stainless)

Garrett, George K., Co., D & Tioga Sts., Philadelphia, Pa.
Harper, H. M., Co., The, 2646 Fletcher St., Chicago, Ill.
Shenango-Penn Mold Co., 407 W. Third St., Dover, O.

WASHERS (Spring)

Barnes, Wallace, Co., The, Div. Associated Springs Corp., 97 Main St., Bristol, Conn.
Garrett, George K., Co., D & Tioga Sts., Philadelphia, Pa.
National Lock Washer Co., Newark, N. J.
Raymond Mfg. Co., Div. Associated Spring Corp., 280 S. Centre St., Corry, Pa.
Thompson-Bremer & Co., 1644 W. Hubbard St., Chicago, Ill.

WATER COOLERS

General Electric Co., (Air Conditioning & Commercial Refrigeration Dept., Div. 431), Bloomfield, N. J.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Westinghouse Electric & Mfg. Co., 653 Page Blvd., Springfield, Mass.

WATER FILTRATION & SOFTENING EQUIPMENT

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Carborundum Co., The, Niagara Falls, N. Y.
Graver Tank & Mfg. Co., Inc., 4600-40 Tod Ave., E. Chicago, Ind.
Worthington Pump & Machinery Corp., Harrison, N. J.

WELDED STEEL CONSTRUCTION

Bartlett-Hayward Div., Koppers Co., Baltimore, Md.

WELDERS (Electric—Arc)

Air Reduction Sales Co., 60 E. 42nd St., New York City
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Hobart Bros., Co., The, Box ST—13, Troy, O.
Lincoln Electric Co., The, Cleveland, O.
Progressive Welder Co., 3050 E. Outer Drive, Detroit, Mich.
Welding Equipment & Supply Co., 220 Leib St., Detroit, Mich.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.
Wilson Welder & Metals Co., 60 E. 42nd St., New York City

WELDING

Air Reduction Sales Co., 60 E. 42nd St., New York City
All-Steel-Equip Co., Inc., 612 Archer Ave., Aurora, Ill.
Bartlett-Hayward Div. Koppers Co., Baltimore, Md.
Bayard, M. L., & Co., 20th & Indiana Ave., Philadelphia, Pa.
Doyle, The, J. E., Co., 1220 West 6th St., Cleveland, O.
Eutectic Welding Alloys, Inc., 40 Worth St., New York City.
Harnischfeger Corp., 441 W. National Ave., Milwaukee, Wis.
Lincoln Electric Co., The, Cleveland, O.
Metal & Thermit Corp., 120 Broadway, New York City
Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.
Scaife Co., Ann St., Oakmont, Pa.
Wilson Welder & Metals Co., 60 E. 42nd St., New York City

WELDING (Resistance)

Progressive Welder Co., 3050 E. Outer Drive, Detroit, Mich.

WELDING (Stainless)

Harnischfeger Corp., 441 W. National Ave., Milwaukee, Wis.
Metal & Thermit Corp., 120 Broadway, New York City.

WELDING (Thermit)

Metal & Thermit Corp., 120 Broadway, New York City.

WELDING AND CUTTING APPARATUS AND SUPPLIES (Electric)

Air Reduction Sales Co., 60 E. 42nd St., New York City
Cutler-Hammer, Inc., 315 N. 12th St., Milwaukee, Wis.
Electric Controller & Mfg. Co., The, 2698 E. 79th St., Cleveland, O.
General Electric Co., Sec. H, 750-159, Schenectady, N. Y.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Hobart Bros., Co., The, Box ST—13, Troy, O.
Lincoln Electric Co., The, Cleveland, O.
McKay Co., The, York, Pa.
Mallory, P. R., & Co., 3029 E. Washington Ave., Indianapolis, Ind.
National Cylinder Gas Co., 206 W. Wacker Drive, Chicago, Ill.
Welding Equipment & Supply Co., 220 Leib St., Detroit, Mich.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.
Wilson Welder & Metals Co., 60 E. 42nd St., New York City.

WELDING AND CUTTING APPARATUS AND SUPPLIES (Oxy-Acetylene)

Air Reduction, 60 E. 42nd St., New York City.
Linde Air Products Co., The, 30 E. 42nd St., New York City.
Liquid Carbonic Corp., The, 3100 S. Kedzie Ave., Chicago, Ill.
National Cylinder Gas Co., 203 W. Wacker Drive, Chicago, Ill.
Welding Equipment & Supply Co., 220 Leib St., Detroit, Mich.

WELDING DIES (Flash)

Mallory, P. R., & Co., 3029 E. Washington Ave., Indianapolis, Ind.

WELDING FIXTURES

Progressive Welder Co., 3050 E. Outer Drive, Detroit, Mich.

WELDING POSITIONERS

Cullen-Friestedt Co., 1300 S. Kilbourn Ave., Chicago, Ill.
Ransome Concrete Machinery Co., Dunellen, N. J.

WELDING RODS (Alloy) (*Also Stainless)

*Allegheny Ludlum Steel Corp., 2319 Oliver Bldg., Pittsburgh, Pa.
*Alloy Rods Co., York, Pa.
Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh, Pa.
American Agile Corp., 5806 Hough Ave., Cleveland, O.
*American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
*Carpenter Steel Co., Reading, Pa.
Champion Rivet Co., The, 11200 Harvard Ave., Cleveland, O.
*Eutectic Welding Alloys, Inc. 40 Worth Street, New York City
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
International Nickel Co. Inc., The, 67 Wall Street, New York City.
*Lincoln Electric Co., The, Cleveland, O.
*McKay Co., The, York, Pa.
Metal & Thermit Corp., 120 Broadway, New York City.
*Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.
Welding Equipment & Supply Co., 220 Leib St., Detroit, Mich.
*Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

WELDING RODS (Bronze)

American Brass Co., The, Waterbury, Conn.
Ampco Metal Inc., Dept. S-1, Milwaukee, Wis.
Bridgeport Brass Co., Bridgeport, Conn.
Eutectic Welding Alloys, Inc., 40 Worth Street, New York City
Revere Copper & Brass, Inc., 230 Park Ave., New York City.
Titan Metal Mfg. Co., Bellefonte, Pa.
Welding Equipment & Supply Co., 220 Leib St., Detroit, Mich.

WELDING RODS (Hard Surfacing)

Eutectic Welding Alloys, Inc., 40 Worth Street, New York City
Harnischfeger Corp., 441 W. National Ave., Milwaukee, Wis.
Lincoln Electric Co., The, Cleveland, O.
Metal & Thermit Corp., 120 Broadway, New York City.
Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.
Wall-Colmonoy Corp., 637 Buhl Bldg., Detroit, Mich.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

WELDING RODS (Magnesium)

Dow Chemical Co., The, Midland, Mich.

WELDING RODS OR WIRE

Air Reduction, 60 E. 42nd St., New York City.
Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh, Pa.
American Agile Corp., 5806 Hough Ave., Cleveland, O.
American Brass Co., The, Waterbury, Conn.
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Ampco Metal, Inc., Dept. S-1, Milwaukee, Wis.
Bridgeport Brass Co., Bridgeport, Conn.
Champion Rivet Co., The, 11200 Harvard Ave., Cleveland, O.
Eutectic Welding Alloys, Inc., 40 Worth Street, New York City
General Electric Co., Schenectady, N. Y.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Hobart Bros. Co., The, Box ST—13, Troy, O.
Keystone Steel & Wire Co., Peoria, Ill.
Lincoln Electric Co., The, Cleveland, O.
Linde Air Products Co., The, 30 E. 42nd St., New York City.
McKay Co., The, York, Pa.
Metal & Thermit Corp., 120 Broadway, New York City.
National Cylinder Gas Co., 205 W. Wacker Drive, Chicago, Ill.
Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.
Revere Copper & Brass, Inc., 230 Park Ave., New York City.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Seneca Wire & Mfg. Co., Fostoria, O.
Welding Equipment & Supply Co., 220 Leib St., Detroit, Mich.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.
Wickwire Brothers, 183 Main St., Cortland, N. Y.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.
Wilson Welder & Metals Co., 60 East 42nd St., New York City.
Youngstown Sheet & Tube Co., The, Youngstown, O.

WELDING TIPS (Spot)

Mallory, P. R., & Co., 3029 E. Washington Ave., Indianapolis, Ind

WELDING WHEELS (Seam)

Mallory, P. R., & Co., 3029 E. Washington Ave., Indianapolis, Ind

WELL WATER SUPPLY SYSTEMS

Layne & Bowler, Inc., Memphis, Tenn.

WHEELS (Buffing and Polishing)

Chicago Wheel & Manufacturing Co., Dept. ST, 1101 W. Monroe St., Chicago, Ill.

WHEELS (Car and Locomotive)

Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Midvale Co., The, Nicetown, Philadelphia, Pa.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.

WHEELS (Grinding)

Bay State Abrasive Products Co., Westboro, Mass.
Sterling Grinding Wheel Div., Cleveland Quarries Co., Tiffin, O.

WHEELS (Track)

National-Erie Corp., Erie, Pa.

WINCHES (Electric)

American Engineering Co., 2484 Aramingo Ave., Philadelphia, Pa.
Graybar Electric Co., 420 Lexington Ave., New York City
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.
Silent Hoist Winch & Crane Co., 849 63rd St., Brooklyn, N. Y.

WINCHES (Gasoline, Diesel)

Silent Hoist Winch & Crane Co., 849 63rd St., Brooklyn, N. Y.

WIRE (Alloy Steel) (*Also Stainless)

*Allegheny Ludlum Steel Corp., 2319 Oliver Bldg., (22) Pittsburgh, Pa.
*American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
*Carpenter Steel Co., Reading, Pa.
Columbia Steel Co., San Francisco, Calif.
*Firth-Sterling Steel Co., McKeesport, Pa.
*Page Steel & Wire Div. of American Chain & Cable Co. Inc., Monessen, Pa.
*Republic Steel Corp., Dept. ST, Cleveland, O.
Roebling's, John A., Sons Co., Trenton, N. J.
Seneca Wire & Mfg. Co., Fostoria, O.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.

WIRE (Aluminum, Brass, Bronze Copper or Silicon Bronze)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh, Pa.
Bridgeport Brass Co., Bridgeport, Conn.
Bristol Brass Corp., The, Bristol, Conn.
Revere Copper & Brass Co., Inc., 230 Park Ave., New York City
Titan Metal Mfg. Co., Bellefonte, Pa.

WIRE (Annealed, Bright, Galvanized)

American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Johnson Steel & Wire Co., Worcester, Mass.
Keystone Steel & Wire Co., Dept. AC, Peoria, Ill.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Roebling's, John A., Sons Co., Trenton, N. J.
Seneca Wire & Mfg. Co., Fostoria, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Wheeling Steel Corp., Wheeling, W. Va.
Wickwire Brothers, 189 Main St., Cortland, N. Y.
Youngstown Sheet & Tube Co., The, Youngstown, O.

WIRE (Barb)

American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Republic Steel Corp., E. 45th & Broadway, Cleveland, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Youngstown Sheet & Tube Co., The, Youngstown, O.

WIRE (Cold Drawn)

American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Johnson Steel & Wire Co., Worcester, Mass.
Keystone Steel & Wire Co., Peoria, Ill.
Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.
Washburn Wire Co., 118th St. & Harlem River, New York City.

WIRE (High Carbon)

American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Roebling's, John A., Sons Co., Trenton, N. J.
Seneca Wire & Mfg. Co., Fostoria, O.
Washburn Wire Co., 118th St. and Harlem River, New York City.
Youngstown Sheet & Tube Co., The, Youngstown, O.

WIRE (Music)

American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Johnson Steel & Wire Co., Worcester, Mass.
Revere Copper & Brass Co., Inc., 230 Park Ave., New York City
Roebling's, John A., Sons Co., Trenton, N. J.
Washburn Wire Co., 118th St. and Harlem River, New York City.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.

WIRE (Nickel Silver)

Revere Copper and Brass Co., 230 Park Ave., New York City.
Seymour Manufacturing Co., The, Seymour, Conn.

WIRE (Phosphor Bronze)

Revere Copper & Brass Co., Inc., 230 Park Ave., New York City
Seymour Manufacturing Co., The, Seymour, Conn.

WIRE (Round, Flat, Square, Special Shapes)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh, Pa.
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Johnson Steel & Wire Co., Worcester, Mass.
Keystone Steel & Wire Co., Peoria, Ill.
Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Roebling's, John A., Sons Co., Trenton, N. J.
Seneca Wire & Mfg. Co., Fostoria, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Washburn Wire Co., 118th St. and Harlem River, New York City.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.
Youngstown Sheet & Tube Co., The, Youngstown, O.

WIRE (Spring)

American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Barnes, Wallace Co., The, Bristol, Conn.
Bethlehem Steel Co., Bethlehem, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Keystone Steel & Wire Co., Dept. AC, Peoria, Ill.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Washburn Wire Co., 118th St. & Harlem River, New York City.
Youngstown Sheet & Tube Co., The, Youngstown, O.

WIRE (Stapling)

American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Dept. AC, Peoria, Ill.
Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.

WIRE (Welding)—See WELDING RODS OR WIRE

WIRE AND CABLE (Electric)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh, Pa.
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
General Electric Co., Sec. G-2903, Appliance & Merchandise Dept., Bridgeport, Conn.
Graybar Electric Co., 420 Lexington Ave., New York City.
Progressive Welder Co., 5050 E. Outer Drive, Detroit, Mich.
Roebling's, John A., Sons Co., Trenton, N. J.

WIRE CLOTH

Cyclone Fence Div., American Steel & Wire Co., Waukegan, Ill.
Roebling's, John A., Sons Co., Trenton, N. J.
Seneca Wire & Mfg. Co., Fostoria, O.
Wickwire Brothers, 189 Main St., Cortland, N. Y.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.

WIRE COILING TOOLS (Cemented Carbide)

Firth-Sterling Steel Co., McKeesport, Pa.
McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.

WIRE COVERING MACHINES

Fidelity Machine Co., 3908-18 Frankford Ave., Philadelphia, Pa.

WIRE FORMS, SHAPES AND SPECIALTIES

American Chain Div. American Chain & Cable Co., Inc., York, Pa.
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Barnes, Wallace Co., The, Div. Associated Spring Corp., 97 Main St., Bristol, Conn.
Columbia Steel Co., San Francisco, Calif.
Firth-Sterling Steel Co., McKeesport, Pa.
Hubbard, M. D., Spring Co., 449 Central Ave., Pontiac, Mich.
Keystone Steel & Wire Co., Peoria, Ill.
Raymond Mfg. Co., Div. Associated Spring Corp., 250 S. Centre St., Corry, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.
Seneca Wire & Mfg. Co., Fostoria, O.

WIRE FORMING MACHINERY

Nilson, A. H., Machine Co., The, Bridgeport, Conn.

WIRE MILL EQUIPMENT

Fidelity Machine Co., 3908-18 Frankford Ave., Philadelphia, Pa.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Lewis Machine Co., 3450 E. 76th St., Cleveland, O.
Morgan Construction Co., Worcester, Mass.
Shuster, F. B., Co., The, New Haven, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

WIRE NAILS—See NAILS

WIRE PRODUCTS (*Also Stainless)

*American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Continental Steel Corp., Kokomo, Ind.
Hubbard, M. D., Spring Co., 449 Central Ave., Pontiac, Mich.

WIRE PRODUCTS—Con.

Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
*Keystone Steel & Wire Co., Dept. AC, Peoria, Ill.
Leschen, A., & Sons Rope Co., 5909 Kennerly Ave., St. Louis, Mo.
Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Roebling's, John A., Sons Co., Trenton, N. J.
Seneca Wire & Mfg. Co., Fostoria, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Wickwire Brothers, 189 Main St., Cortland, N. Y.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.
Youngstown Sheet & Tube Co., The, Youngstown, O.

WIRE ROPE AND FITTINGS

American Cable Div. of American Chain & Cable Co., Inc., Wilkes-Barre, Pa.
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Hazard Wire Rope Div. of American Chain & Cable Co., Inc., Wilkes-Barre, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Leschen, A., & Sons Rope Co., 5909 Kennerly Ave., St. Louis, Mo.
Macwhyte Co., 2940 14th Ave., Kenosha, Wis.
Roebling's, John A., Sons Co., Trenton, N. J.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.

WIRE ROPE SLINGS

American Cable Div. American Chain & Cable Co., Inc., Wilkes-Barre, Pa.
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Hazard Wire Rope Div., American Chain & Cable Co., Inc., Wilkes Barre, Pa.
Leschen, A., & Sons Rope Co., 5909 Kennerly Ave., St. Louis, Mo.
Macwhyte Co., 2940 14th Ave., Kenosha,, Wis.
Roebling's, John A., Sons Co., Trenton, N. J.

WIRE SPOOLING MACHINES

Fidelity Machine Co., 3908-18 Frankford Ave., Philadelphia, Pa.

WIRE STRAIGHTENING AND CUTTING MACHINERY

Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Lewis Machine Co., 3450 E. 76th St., Cleveland, O.
Shuster, F. B., Co., The, New Haven, Conn.
Watson-Stillman Co., Roselle, N. J.

WIRE WINDING MACHINES

Fidelity Machine Co., 3908-18 Frankford Ave., Philadelphia, Pa.

WRENCHES (Drop Forged)

Williams, J. H., & Co., 400 Vulcan St., Buffalo, N. Y.

X-RAY EQUIPMENT (Industrial)

Westinghouse Electric and Mfg. Co., Baltimore, Md.

ZINC

New Jersey Zinc Co., 160 Front St., New York City.

ZINC ALLOYS

New Jersey Zinc Co., 160 Front St., New York City.

ZINC (Rolled Sheets, Strips, Coils)

New Jersey Zinc Co., 160 Front St., New York City.

ZIRCONIUM METAL AND ALLOYS

Electro Metallurgical Co., 30 E. 42nd St., New York City.